RAILROAD GAZETTE

FRIDAY, JULY 6, 1900.

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Exhaust Port Width—A Correction.

Among dimensions given for ports of Engine No. 150, Pittsburgh, Bessemer & Lake Erie Railroad, appeared "exhaust ports, width 2¼ in." Inquiry was sent to the builders asking permission to change this dimension to read 3¼ in., but confirmation was received too late for last week's issue. The dimension, 2¼ in., is wrong. The correct width is 3¼ in.

Boiler Plate Specifications—A Correction.

In the article (issue of June 22d), "Open-Hearth Steel Boiler Plates," comparing specifications proposed by the American Committee of the International Association for Testing Materials, with the standard specifications of the American Railway Master Mechanics' Association, a slight error occurred. In Fig. 1, Boiler Shell Steel, in the block column to the right, the minimum elongation in 8 in., recommended by the American branch of Committee No. 1, should read, on the lower block, "25" per cent., instead of 26 per cent. In correcting an error in the original diagram the numerals, 26, were permitted to remain unchanged and the solid block was not reduced to the, dotted, 25 per cent. line. The intent of the diagram is entirely apparent, however, and, although the error is slight, so much value attaches to the article as a whole that we hasten to set the matter right.

Contributions.

A Stadia Survey.

TO THE EDITOR OF THE RAILROAD GAZETTE.

Some of your readers may be interested in the results of a stadia survey made some three years since. The point of interest is the precision obtained in levels. The purpose of the survey was to determine the correctness of the contours shown on one of the United States Geological Survey sheets which had been used in projecting a proposed water supply. The precision required was not great, it being assumed that a check within 4 or 5 ft. would be ample for the preliminary work then contemplated.

Having used the stadia a great deal with much satisfaction, I adopted this method of doing the leveling. The line run was some 15 miles long, nearly 10 miles being run the first day with an early stop to catch a train. The sights varied from 250 ft. to over 1,300 ft., a 12-ft. stadia board being used, and the line run generally in a country road, cut-offs across fields being sometimes made. As a map of the line was not required, only distances and vertical angles were read. Some of the distances were too long for good practice, and were taken only because it was thought the approximate character of the work warranted them.

No opportunity to check the work with levels occurred until recently—three years after the stadia line was run. A recently run level line which was itself checked to within 0.09 ft., touched on two bench marks of the stadia levels, one 10 miles out, another about 15 miles. The difference found for both was 0.9 ft. The fact that these two benches, 5 miles apart, give the same check seems to indicate that the stadia error occurred in the reductions, rather than in the field work. However it occurred the closeness of the check will be a revelation to some people who have not much used the stadia, and will be comforting to those who have learned to use it but have had no opportunity to check results. An instrument with sensitive plate bubbles, and high magnifying power was used.

Considering the speed, which was probably twice what could have been had with a level over the rolling ground traversed, the result is exceedingly satisfactory, and is a strong argument for the use of the transit and stadia in reconnoissance and preliminary railroad surveys.

WM. G. RAYMOND.

The Crossing Bell.

Philadelphia, June 23, 1900.

TO THE EDITOR OF THE RAILROAD GAZETTE.

The editorial on page 424 of the *Railroad Gazette* of June 22, on the question of whether safety requires an attendant or an audible warning apparatus at a railroad crossing, is very interesting.

An absolutely reliable audible warning apparatus would be a great relief, and solve the problem in many instances, but I have never been able to satisfy myself as to the propriety of their use. It is a notorious fact that, in the trial of suits for damages at railroad crossings, the averments of the plaintiffs are almost uniformly to the effect that no whistle signal nor engine bell signals were given, and it is not infrequently the case that the defendant can absolutely prove to the contrary by the testimony of witnesses other than railroad employees. In the light of this experience, I apprehend that the averment would always be that the warning bell or audible signal did not sound, and in nine cases out of ten we would be without any means of proving that it did. I have tried such signals, and found them not absolutely reliable.

The editorial goes on to say that an attendant or a bell at a crossing is in one sense a luxury. I do not think a bell at a crossing, if it were an effective precaution, could be regarded as a luxury, unless it were an insignificant crossing; while an attendant means, as a rule, two attendants, and this is equivalent to a capital of somewhere about $10,000.

The object of this letter is more to know what the opinion of the *Railroad Gazette* is as to the protection afforded by automatic audible crossing signals. If the journal does not care to express an opinion on that subject, please take no notice of this letter. If it does, I am sure the opinion would be well considered and of value to your readers. E. M.

[We quite agree that an absolutely reliable automatic audible warning apparatus would solve the problem at crossings where the volume of traffic is not small, yet is not large enough to warrant having an attendant. As our correspondent is a managing officer of long experience and high repute we accept his view that such a bell would be worth what it costs, and would not be a luxury. The question turns on the degree of reliability. Crossing bells, generally, have no good reputation. Many competent observers believe that they do more harm than good, as they ring when no train is approaching, and fail to ring when one is approaching. Defective service may come from poor design, bad workmanship, inefficient inspection and maintenance, or the attempt to make a bell serve where no automatic device can meet the conditions. The fact that railroad officers continue to introduce bells here and there would seem to indicate that the first three of these causes of failure are not hopelessly incurable. Those who use bells, and advocate them as a means of safety at places where the expense of an attendant can not be borne, will admit that the difficulty of proving to a jury that a bell actually did ring at a certain time is not done away with; and would not be done away with even by an ideally perfect apparatus; but the same argument holds against the engine bell. As a matter of observed fact, do automatic alarm bells keep people from crossing the tracks; do they lure people on to the tracks by false indications? What has been our experience? "Fool, said my muse to me, look in thy heart and write."—Editor.]

II.—Railroad Concrete Masonry.

BY W. A. ROGERS, M. AM. SOC, C. E.*

(*Continued from Page 403.*)

MANUFACTURE.

Mixing.—Concrete is mixed both by hand and by mixing machines especially designed for the purpose. In hand mixing the method favored by the writer is to spread the sand or gravel in a thin layer on the floor of a water-tight box and then the cement evenly over the top of it. The two are then thoroughly mixed dry, after which all of the water required is added and the mass again mixed. During this time another set of men have spread the stone evenly over a second water-tight platform alongside of and 4 in. to 6 in. lower than the mortar box. If the stone is a soft or porous one, or if the weather is warm and dry, it is wetted and then the mortar is distributed over it by means of shovels, scoops or hoes. The mass is then turned until each particle of stone is surrounded by a coating mortar, generally about 3 turning being sufficient. It is then ready to be wheeled to place.

There are two general classes of mixing machines used in the making of concrete. The screw mixers and the revolving box mixers. The principle of the screw mixer is a horizontal shaft with either a continuous blade or set of paddles fastened spirally to it, working in a trough slightly larger than itself. At one end is generally a chute through which the materials are dumped on the continuously moving screw by which the material is conveyed from the end where it is charged to a chute at the other end where it is discharged and wheeled to the work. In traveling this distance the action of the screw rolls it over and over and mixes it. There is no way to control the amount of mixing with this class of machine. Sometimes the materials are dumped at the same time, or the sand and cement are dumped together, the stone farther along and the water added still farther along the screw. Occasionally, the materials are shoveled directly from platforms to the screw, the men timing their work so that the right proportions are maintained. The quality of the mixture depends largely on the way in which the materials are delivered to the screw. If they are delivered properly a good concrete will result, but if not then a concrete rich in one ingredient at one time will be followed by a mixture poor in the same ingredient.

Of the revolving box mixers, there are a number of different kinds. One of the most common is a cubical steel box, with a door in one side or one corner through which it is charged and discharged, revolving on a hollow horizontal shaft. The cement, sand and stone are dumped into the mixer through the door by means of a chute, and, after a few turns to dry mix the materials, the necessary water is added through the hollow shaft; then after a certain number of turns more the box is stopped and the mixed product emptied and wheeled away. The amount of mixing is entirely under the control of the operator, but it is necessary to stop and start the mixer for each separate charge. With this form of machine there is the disadvantage that the operator can not see the process of mixing. A modification is one in which the box is not in the form of a cube but is many-sided.

Another form of mixer is in the shape of a hollow cylinder, on the inside of which are two movable blades or deflectors, about 4 in. to 6 in. wide, placed parallel to the axis of the cylinder and diametrically opposite each other. Between these two movable blades are four fixed blades arranged to deflect the material from side to side during the process of turning. In each end of the cylinder is a circular opening. Through one of these the concrete materials are dumped into the mixer by means of specially shaped wheelbarrows, and into the other an inclined tray or trough extends through to the opposite end of the cylinder. This tray is hinged in its middle parallel to the axis of the cylinder, so that it may be closed on itself during the process of mixing. The cylinder is placed with its axis horizontal on four anti-friction rollers bearing on a projecting rim on the ends and a little larger than the circular openings mentioned. It is turned by power applied to the rim of the cylinder. The process of mixing is as follows: The required amount of water is discharged into the continuously revolving cylinder through a pipe extending into it through the circular opening at the discharge end. The materials properly measured are then charged into it in the order of first cement, then sand and last broken stone. The blades or deflectors on the inside of the mixer deflect the materials from side to side and thoroughly mix them together. During the process of mixing the movable blades are placed in such a position that the mass is carried over the chute or tray. When mixed sufficiently they are changed so that the concrete is raised up and discharged onto the inclined chute, down which it slides into the wheelbarrows placed beneath the end. The movable blades are under the control of the machine tender, who stands at the discharge side of the mixer. With this, the Ransome machine, the operation is under the observation and control of the operator at all times, and mixing may be carried on as long as he desires. The writer is more familiar with it than any of the others described, having two of them on work under his direction, one of a nominal capacity of 75 cu. yds. and the other of 50 cu. yds. in 10 hours. This capacity may be doubled, however, by either of the machines. In the writer's opinion it is impossible to mix concrete any better than it is mixed by this machine, and that it can not be equaled by hand when a soft or porous stone is used. A very convenient form of this mixer for railroad and other work where the jobs are not large and are scattered is that in which the mixer and a gasoline engine to run it are mounted on wheels on the same frame. Where frequent moving is the rule this is of great advantage, saving both time and money in moving and setting up. Figs. 1, 2 and 3 show a Ransome concrete mixer of 50 cu. yds. capacity mounted on a wagon frame with a Lewis gasoline engine.

The question is often asked as to whether hand mixed or machine mixed concrete is the better. As to quality the writer believes that with either the cubical or box mixer and the cylindrical mixer just described, it can be mixed better than by hand, and the chances are that it will be, and that with the screw form of mixer the quality of the finished product depends very much on the care, and the chances are that it will be no better than that mixed by hand. Where the amount of concrete to be built at one locality is reasonably large, there is little question but that machine-mixed concrete is the cheaper.

Water.—The amount of water to be used in mixing is a question on which there has been much discussion, and practice in this respect varies widely. A few years ago it was the almost universal rule that concrete was mixed just wet enough so that repeated ramming was required

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to bring moisture to the surface. This practice has been gradually changing until at the present time many engineers prefer a moderately wet concrete or even one which quakes under slight tamping. There are many advantages in favor of the wetter mixtures and the writer believes that in general better results are obtained by their use. Comparative tests of the strength of wet and dry mixtures point to the fact that at short times the strength developed in laboratory tests is somewhat greater in the case of the dry mixtures than in the case of the wet, but that the latter eventually become as strong as the former.

The practical advantages in favor of the wetter mixture are that it is very much easier to mix the ingredients well together when plenty of water is used; that the cement sets slower, allowing the concrete to stand longer without damage; that there is a better union between succeeding courses and that less tamping is required to get a compact mass, and for work above ground the surplus water provides for the absorption of water by the wooden forms and the evaporation due to the atmosphere. The writer is in favor of a quaking concrete for work above the ground, especially during the summer months. The amount of water used should be decreased during cool or freezing weather.

Courses.—Concrete should be deposited in layers not exceeding 6 in. in thickness and compacted as much as possible by tamping. If a much thicker layer is used the effect of the tamping will be expended on the top and will not reach through to the bottom. As far as possible each layer should be deposited before the one previously placed has set. In ordinary work it is impossible to carry on work continuously, that is night and day, but where the work is of sufficient magnitude it is of advantage to do so; whenever a layer of concrete is placed on one which has already set a horizontal crack may form. To prevent this as far as possible the top should be cleaned, wet and covered with a thin grout.

It is frequently advisable also to use some device to lock courses together, as for instance the footing and neat work. After the footing is completed it is usually necessary to allow it to stand for some time while the form or mold for the neat work is being built and its top becomes more or less dirty, and some of the dirt is apt to remain in little depressions preventing a perfect union with the neat work. The footing is also frequently of natural cement concrete and the neat work of Portland cement concrete, and the union between these two may not be as strong as it would be if both were of the same class of concrete. In cases like this the writer finds it desirable to use a device similar to one of the following: A groove is formed in the top of the last layer by placing in it with the top even with top surface of the layer, one or more lines of plank or other timber slightly beveled to facilitate easy removal when desired and leaving them there until ready to start concreting again, when they are taken out. This will form a trough or groove into which the next layer will enter, locking the two together. Where pieces of good stone of moderate size may be readily obtained a number of them may be placed in the last layer not too close together, with about half of each stone projecting above the top of the layer. When the next course is built, these stones serve the same purpose as the groove, formed by the plank, in locking the layers together. Instead of the stones, iron dowels may be used to good advantage. In any case there should be no stoppage within less than 18 in. of the top of the wall.

Facing.—The question as to whether the exposed surface of concrete subject to the action of water, or the weather, should be protected by a facing of mortar is one on which there is a diversity of opinion. There is some question as to its necessity as a protection, and in the case of natural cement concrete some uncertainty as to whether it will not eventually separate if it is made of Portland cement mortar. In putting on the facing, when it is used, much depends on the method followed. It may be laid down as a general rule that it should be built up at the same time as the concrete backing and both tamped well together. A convenient tool used by the writer for several years for this purpose consisted of a piece of steel ¼ in. thick, 6 in. wide and from 4 ft. to 6 ft. long, on

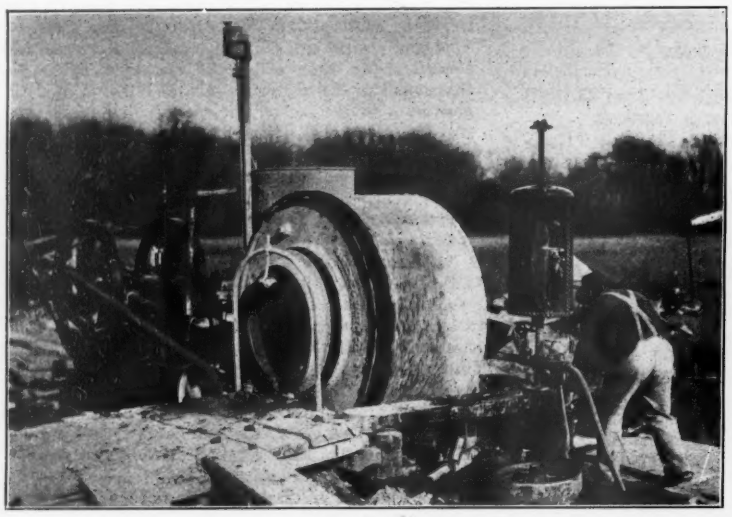


Fig. 1.—Ransome Portable Concrete Mixer, Run by 4 H. P. Lewis Gasoline Engine, Both Mounted on the Same Frame. View Shows Side From Which Mixer Is Charged.

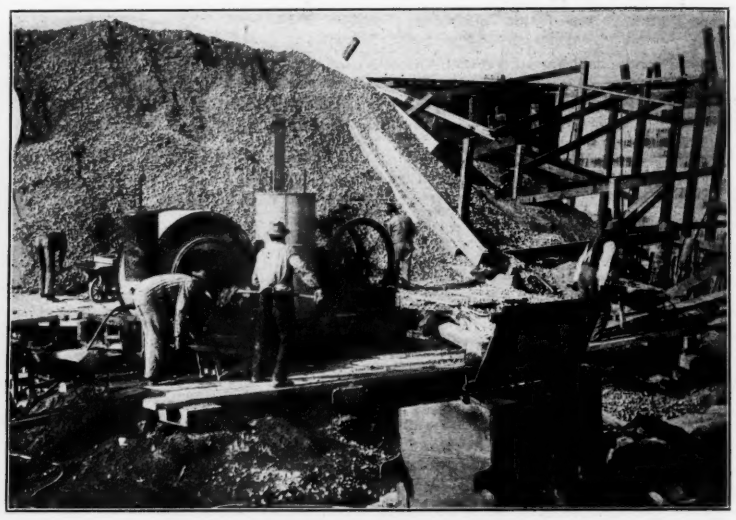


Fig. 2.—Same as Fig. 1, Showing Discharge Side.

Fig. 3.—Mixing Concrete With a Ransome Mixer.

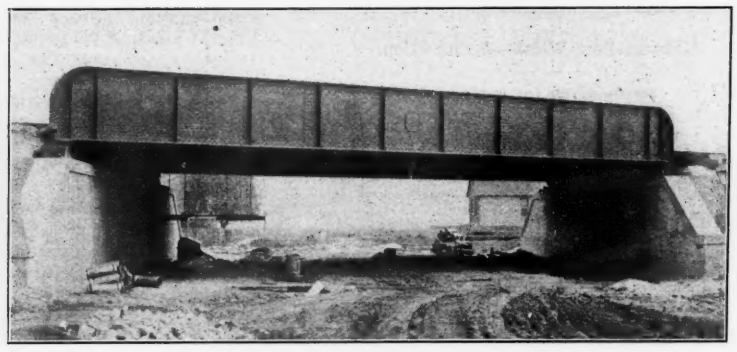
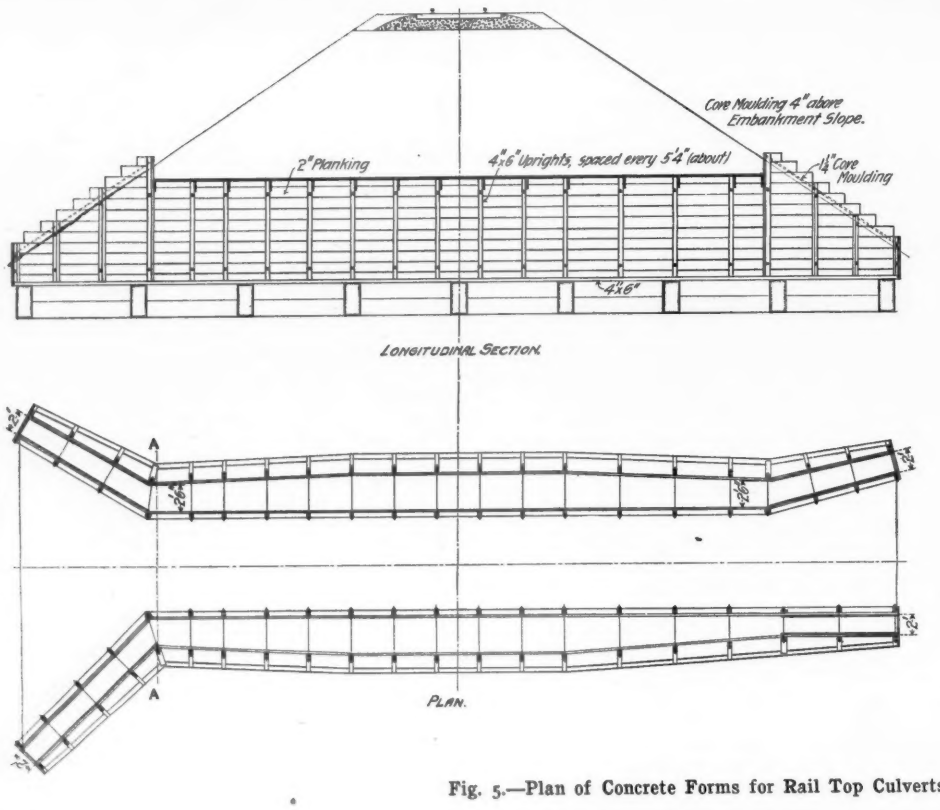


Fig. 4.—Abutments of Portland Cement Concrete—Elevation of the Tracks of the C. M. & St. P. Ry., Chicago.



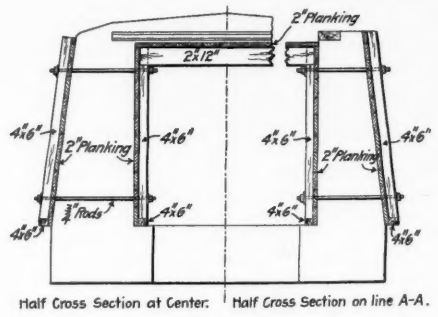


Fig. 5.—Plan of Concrete Forms for Rail Top Culverts.

one side of which are riveted two 1½ in. x 1½ in. angles, 6 in. long, at right angles to its length and 6 in. to 12 in. from the ends; on the other side are riveted two handles. In place of angles being riveted on one face the ends may be bent over 1½ in. This tool is placed with the angle side next to the form or mold, and the 1½ in. space between it and the mold is filled with mortar and the concrete is deposited back of it, after which it is pulled out and both the concrete and facing tamped. This forces the stones of the concrete into the mortar and they become one mass, giving a 1½-in. mortar face, the thickness of facing recommended where one is desired. For ordinary bridge abutments, low piers or culverts built of Portland cement concrete a good, smooth wearing surface may be made by working a spade up and down several times along the side of the form. A very good bearing surface on top may also be made by using a fairly wet concrete and smoothing it carefully.

Where facing is used a mortar of 1 part of Portland cement to 3 parts of sand is used as a rule. Too rich a facing causes a tendency to form hair cracks in the surface. The added cost of facing concrete is considerable, both in material and labor, and the extra amount of cement is quite an item, especially in the case of a narrow wall or of a pier. In the case of the Portland Cement concrete abutments built in connection with the elevation of the Chicago, Milwaukee & St. Paul tracks in Chicago, the cement used in putting a 1½-in. facing of 1 cement to 2 sand mortar on fairly heavy abutments amounted to about 9 per cent, of the cement used in the entire neat work. A pair of these track elevation abutments are shown in Fig. 4. Also, in the case of a narrow wall, the speed of the work is frequently impeded by the inability to carry up the facing fast enough and in any case two or more extra men are needed to mix and carry mortar and to attend to placing the facing inside of the form. For these reasons it is advisable to omit the facing where possible. In the case of Portland cement concrete it is a question as to how much it adds to the weather-resisting qualities. A convenient tamping iron is made with a cast-iron base 6 in. or 7 in. square weighing about 30 lbs. with a 1¼-in. gas pipe screwed into it for a handle.

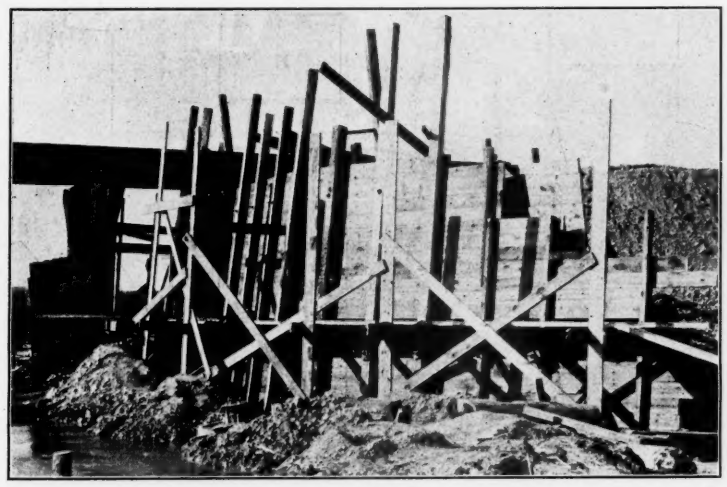


Fig. 6.—Form for Concrete Abutments.

Expansion and Contraction.—Concrete expands and contracts with variations of temperature at about the same rate as iron, and allowance should be made for this in building long walls. In ordinary abutments or culverts where the wall is not over 60 ft. long the writer has not been in the habit of making any allowance, but for greater lengths he is in favor of dividing the wall into about 40-ft. sections. The method followed is to build a bulkhead at the ends of the proposed sections, these bulkheads being removed as soon as the concrete has sufficiently set in a section, and the next section is built against the vertical face of that previously built. There will undoubtedly be a bond between the adjacent sections, but a joint will be formed which will be weaker than the rest of the wall, and when contraction takes place a vertical crack will open up at that point. In building the bulkhead a plank is placed vertically on the side against which the concrete is deposited to form a vertical groove, which groove is filled when the next section is built, thus locking adjoining sections in the same vertical plane. By this arrangement the location of a vertical temperature cracks are fixed by the engineer, in the most suitable places and instead of unsightly crooked cracks we get straight vertical joints. Walls are also frequently divided into short sections, so that each section may be completed continuously or with a minimum number of stoppages, and therefore with fewer chances of horizontal cracks appearing. Very small cracks, which it would be difficult to find in stone masonry, show up very plainly in concrete, and it is probable that as many cracks are formed in stone masonry as are formed in similar classes of concrete.

Metal Ties and Strengtheners.—Concrete adheres very closely to iron or steel, and their use to strengthen or to tie different parts of a concrete wall together is a common practice. Old rails, old Howe truss rods, I beams, bolts, and old chains are used in this connection. In the case of the main pier of a drawbridge built in Chicago during the early part of last year, old Howe truss rods were imbedded in the concrete in such a way that they would hold together different parts of the pier which might have a tendency to separate, and vertical and horizontal rails as well were placed in it to add to the strength. Rails are built into footings frequently where the ground is a little soft to add stiffness.

In the case of culverts resting on a soft soil and over which a high fill is made there is a tendency to crowd out the ends of the culvert in the direction of the length, that is to stretch the culvert. This is shown in the case of iron pipe culverts which are frequently unjointed by the same force. In order to prevent this elongation in one case, there was built in each of the footings of a culvert in a high fill a line of worn-out chain, and in another case, two lines of light narrow gage rails were used through the bolt holes of which drift bolts were placed to add to the resistance of the rail to pulling through the concrete. It is said that concrete is a preventive of rust, and this seems to be borne out by fact inasmuch as it is reported that pieces of iron found in mortar placed long ago are still free from corrosion.

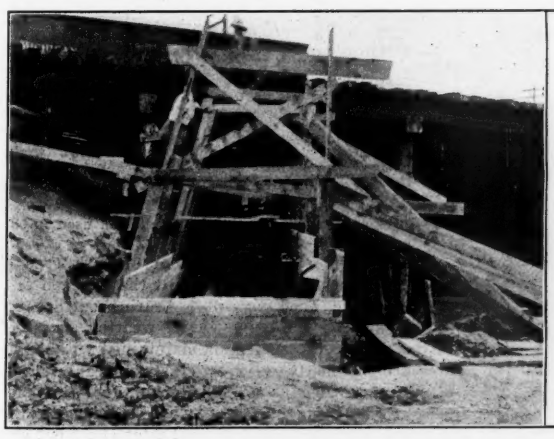


Fig. 7.—Inside of Form for a Concrete Abutment.

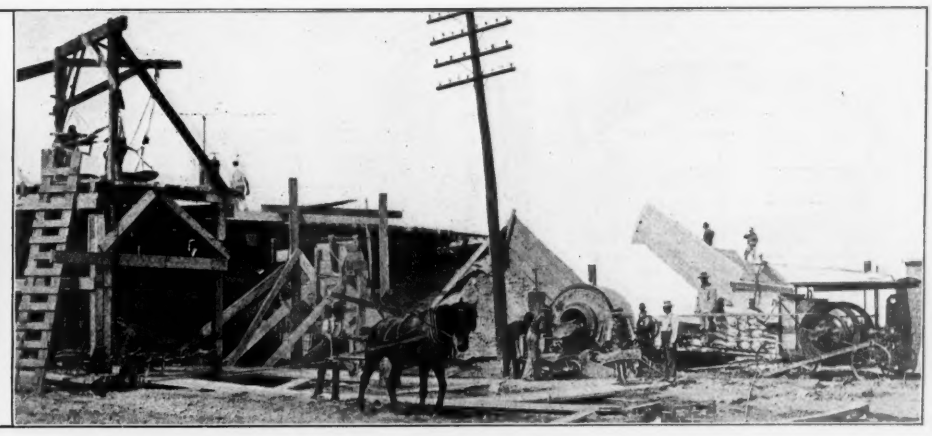


Fig. 8.—Device for Raising Concrete by Horse-Power, Used by the C. M. & St. P. Ry. Bridge & Building Department.

Forms.—The construction of the form or mold for the ordinary low abutment or culvert wall is a comparatively simple matter. The practice followed by the writer is to use 4 in. x 6 in., or 6 in. x 6 in. uprights, with 2-in. plank surfaced on one side and two edges lightly nailed against the posts to form the faces of the wall. A uniform width of plank has been selected to facilitate its use, and a 10-in. width has been settled on as a convenient size. The front and back faces of the form are held at the proper relative distance from each other by means of rods through opposite posts. The front is usually held in line by bracing to stakes driven in the ground, or to the piles if built through a pile bridge. For the ordinary culvert or low abutment a rod at the bottom and top of each opposite set of posts of the dimensions stated has been found to be sufficient. The bottom rod is located usually below the surface of the ground and is left in the concrete and the top rod where possible is placed through the posts above the top of the wall and is removed when the form is taken down. When it is not placed above the top of the form or when more than two rods are used, they are cut off at the face of the concrete and left in the wall. In the case of the smaller culverts it is frequently possible to brace between the front side of the forms of the two walls and to hold the backs of the forms in place by blocking against the piles or bank, and in this way omitting the rods. The face planks are required to be placed level. Where an especially smooth surface is desired, the planks for the face are surfaced both sides and to a specified thickness. Fig. 5 shows the standard plan of concrete form used by the Chicago, Milwaukee & St. Paul in building rail-top culverts.

The posts are spaced either 5 ft. 4 in. or 4 ft. centers where 16-ft. planks are used. For high piers or abutments a heavier post is used, say 6 in. x 8 in., or 8 in. x 8 in., or two 3-in. planks bolted together with 1-in. blocks between them. These are placed so that the planks are nailed against the edges and the rods passed through the space between the plank with the nut and washer against the outer edge. In the case of arches the lagging is beveled to give a fairly tight upper surface. Figs. 6 and 7 show the form used for a Portland cement concrete abutment.

For round pier noses or turntable pits planks of a suitable width to form the rounded part are placed vertical. Sharp edges on account of the liability to chip off are objectionable and a ¼-round cove is tacked in each square turn of the forms, giving a rounded corner in the finished wall. Various sizes of cove are manufactured thus permitting the selection of a size suitable to each special place. The tops of wings of culverts and abutments are built on a slope to correspond to the slope of the embankment. In making the forms for the wings the ends of the plank are not sawed off to conform to the slope but a strip of cove of a suitable size is nailed on each face of the form with its top on a line with the proposed top of wing; the concrete is deposited roughly to the proper height and then struck off with a straight edge resting on the strips mentioned. The same method is used to advantage in finishing the top of abutments and piers.

For small piers of the same size, the forms may be made in sections which may be taken down from one pier and set up for use at another, but for other railroad structures the sizes and shapes are so diverse that as yet we have been unable to devise a satisfactory kind of removable form. The lumber used in building the forms may be used over and over if care is taken in handling. The cost of material and labor in building forms for the ordinary culvert or abutment will be between 35 cents and 85 cents per cu. yd. of masonry, depending on the simplicity of shape and the size of the wall. The construction of the form is susceptible of considerable improvement.

In the writer's practice it is the custom usually to finish the form for any particular part before starting the concrete in it. Others carry up the sides of the form as the concrete is deposited, but this necessitates more or less sawing and fitting, and chips and saw dust are apt to be scattered on the top of the layer last deposited, making a more or less defective joint, and also necessitates more or less unnecessary tramping on a possibly partly set concrete. It also requires two different set of workmen to be employed inside of a narrow space and they unavoidably interfere with each other.

Handling Concrete.—In placing large masses of concrete, machinery other than the mixing machine may be used to advantage in reducing the cost and facilitating the work. In the construction of the abutment and main pier of a 175-ft. counterbalanced girder swing bridge, built in Chicago during 1899, the following arrangement was used. The abutment and pier mentioned were part of the circumference of a circle 67 ft. in diameter, each part extending over about 90 deg. and being diametrically opposite each other. A concrete mixer was placed about 50 ft. from the center of the circle and from the discharge side towards the center a push car track was built, a der-

rick being placed as near the latter point as possible. As the concrete was mixed, it was discharged into ½-yard steel dirt buckets placed on a push car on the track mentioned, then run within reach of the derrick, when it was picked up, swung around, lowered to place and dumped just where required. This arrangement resulted in increased rate of progress and saving in cost.

In the construction of high piers and abutments where the mixing platform can not be built near the level of the top of the structure it is our aim to use some power, other than man, to raise the concrete to the top of the wall and have the wheeling on level runways. One method adopted has been to build a frame with a platform slightly above the top of the wall with two uprights extending about 7 ft. above the top of the platform. Between the tops of these uprights a cross-piece with a sheave over an opening in the platform is placed. The wheelbarrow loaded with concrete is raised through this opening in the platform by means of a rope passing up and over the sheave mentioned. The barrow is guided by means of a vertical groove in which the wheel travels and a vertical plank is so placed that it guides the handles. For low lifts where the amount of concrete is not too great a horse is used for power. Fig. 8 shows this arrangement. For high lifts and where a large amount is mixed per day a 4 h. p. gasoline engine has been rigged up with a spool of a size to give the desired speed of hoisting. The engine runs continuously and when a load is to be lifted a couple of turns of the hoisting rope are taken around the spool; when the barrow is landed the rope is thrown off from the spool and lowered ready for another load.

The empty barrows are lowered by means of a rope passing over a sheave, to one end of which they are fastened and to the other end of which is a counterweight. Another scheme used has been to suspend two platforms, each large enough to take a barrow in a frame in such a way that when one is raised the other is lowered. A team is used to operate this, raising the loaded barrows up to the proper level and lowering the empty barrows to be filled.

(To be concluded.)

Balanced Piston Valves—Inside Admission.

Newly-designed piston valves have just been brought out by the American Balance Slide Valve Co., of Jersey Shore, Pa., and San Francisco, Cal. These valves were exhibited at Saratoga during the Master Mechanics' convention last month. They attracted much attention and received a great deal of favorable comment. The control of packing rings is unique and worthy of careful consideration. The design is simple, consisting of the main rings, a wedge snap ring, and the small auxiliary ports.

In Figs. 1 and 2 we illustrate two types of valve, Fig. 1 showing a wide ring valve, made for the Chicago & Northwestern Railroad, and Fig. 2 showing a valve with two smaller rings. The letters used in the table of reference, appearing herewith, apply to the same parts in each Figure, with the addition of letters for parts contained only in Fig. 2. The description can therefore be followed by the letters, referring to either illustration. A is the wedge ring; B, the main snap rings; D, the follower; E, the valve spool; F, relief holes from interior of main ring to exhaust; G shows ports to admit live steam to inner or outer side of the wedge ring, depending upon the type of valve; H shows forms of joints covering the cut of the wedge ring; I shows forms of joints covering cut in the main ring. The valves are made with follower heads, and spool body. The valve stem, to properly receive them, can be made with solid shoulder turned as part of the stem, to retain the valve at one end, and nuts may be placed at the outer end; or, lock nuts may be used at both ends, upon a threaded stem, to afford adjustment, if desired. To follow the action of the packing rings, it is necessary to keep in mind that both designs shown are of the inside admission type.

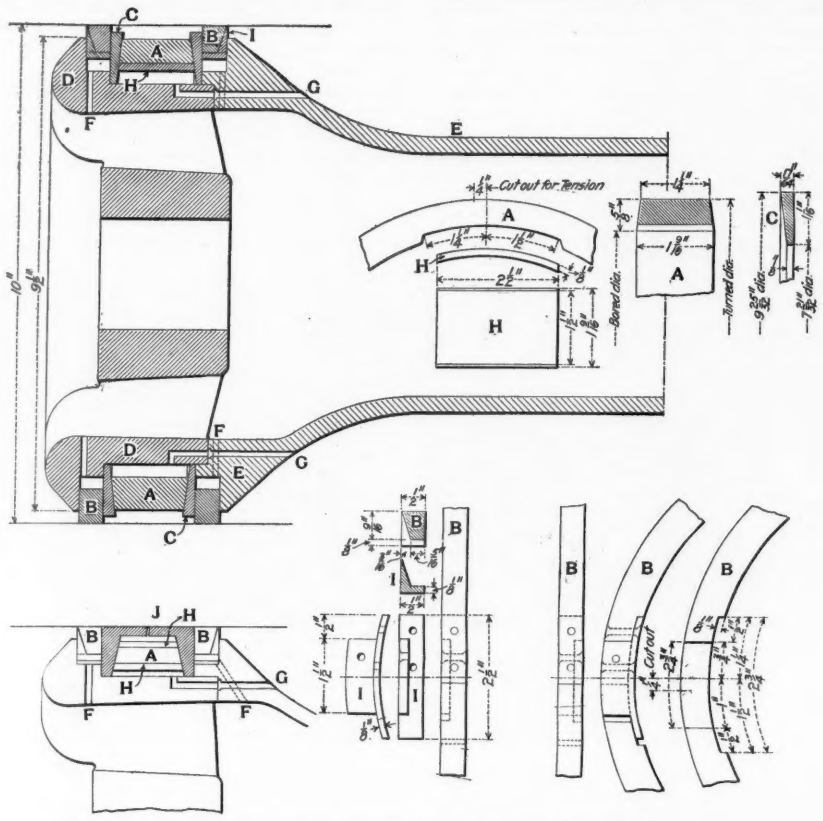


Fig. 2.—American Balanced Piston Valve—Narrow Rings.

It will be noticed that, by the form of joint used to cover the cut in the main snap rings, unbroken steam and exhaust lines are secured. In Fig. 2, showing the application with two small rings, there is the addition of two solid rings, C, which form the inner walls for the packing rings. These rings, C, are set apart by the wedge ring A, which action clamps the snap rings in their grooves. The wedge ring is all important to both designs. Its functions are, first, to prevent the live steam from getting into the interior of the main ring; second, to wedge the main ring against the wall of the groove and convert it into a plug, of the exact size of the valve cage, while working under steam pressure; and, third, to prevent lateral wear of the main rings, from oscillation, either while working under steam or while drifting. The operation of this wedge ring is positive, as it is actuated by the steam chest pressure on its outer circumference, closing it in one design, Fig. 1, and on its inner circumference, expanding it in the other design, Fig. 2. In either case it acts as a wedge, driven between the wall of the valve and the side of the main ring, thus clamping the main ring rigidly and holding it so during all the time of its operation under pressure. When steam is shut off, the tension on the wedge ring, the natural spring action of which is to close in Fig. 1 and to open in Fig. 2, is not sufficient to prevent the main ring from expanding in the cylinder to take up the wear, but is great enough to prevent all end-throw between faces. Heretofore, it has been impossible to use the wide rings in the piston valve, owing to excessive friction caused by internal pressure expanding them, and while the narrow rings have been more successful the pressure has still been allowed to expand them against the cylinder, causing excessive wear at short stroke of the valve and correspondingly early destruction to valve gear. It would seem that, with the design of valve here illustrated, where ground joints are made against the side of the ring and the wall of the valve, and where the wedge ring grips the main ring firmly, the wear of the rings and valve casing should be very slight, and that, the danger of excessive wear at short stroke is materially reduced.

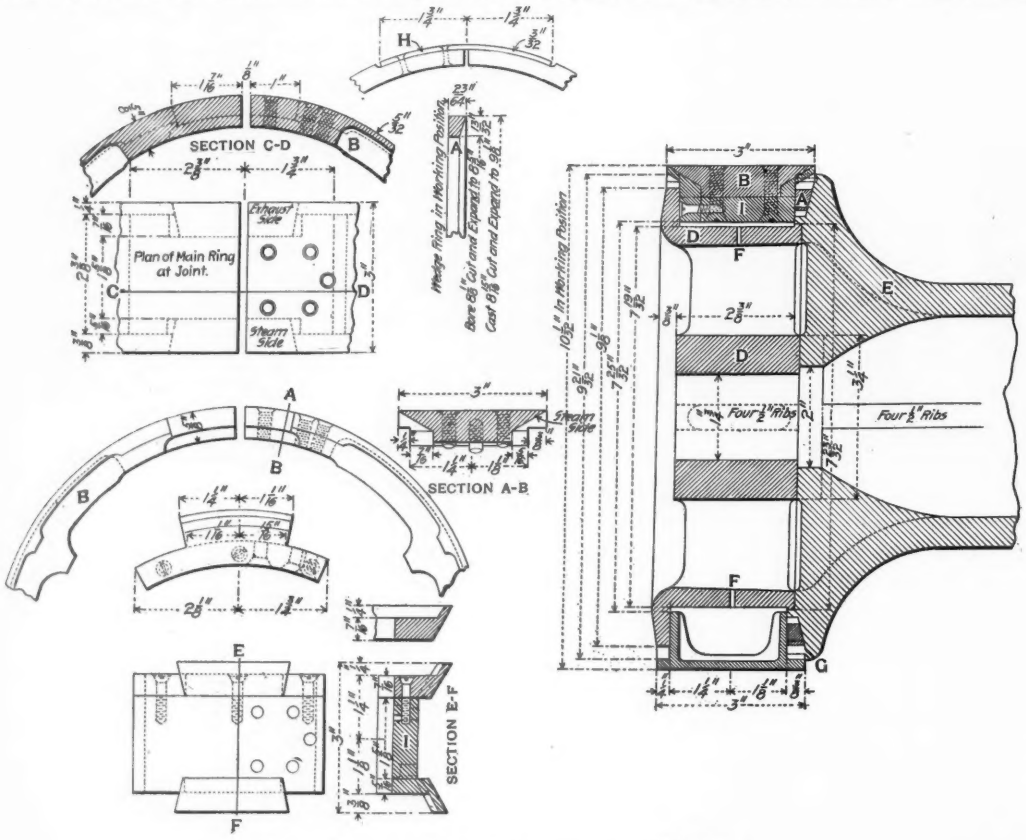


Fig. 1.—American Balanced Piston Valve—Wide Ring.

Reference Table.

A—Wedge ring, expanded by steam pressure admitted through ports "G."
B—Snap rings, of any desired size.
C—Solid rings, with or without flanges.
D—Follower.
E—Valve spool.
F—Relief, from space below snap rings to exhaust.
G—Live steam ports, connecting space below wedge ring "A" with steam chest.
H—Forms of joints covering cut in wedge ring "A."
I—Form of joint covering in snap ring "B" (giving continuous steam and exhaust line).
J—Section showing rings "C" flanged and used to carry the valve.

The principle in the operation of both types is the same. The wide rings, shown in the Chicago & Northwestern valve, each present a bearing surface of 94.24 sq. in., making 188.48 sq. in. of wearing surface in the valve. This large surface if maintained without internal pressure should give very satisfactory wear. The holding of the main ring as a plug during its operation under pressure is very important when considering that the greatest percentage of its travel is at short cut off. The slight probable wear of the rings and casing at such travel should result in economy in maintenance and effective steam distribution. These valves are called the American Balanced Piston Valve. They are made either as inside or outside admission valves as desired by users.

Richmond 10-Wheeled Locomotives—Finland State Railroads.

The Richmond Locomotive & Machine Works has completed ten 10-wheeled, simple, passenger locomotives for the Finland State Railroads. Nine of these engines were shipped direct to Helsingfors, Finland, and the tenth, illustrations of which appear herewith, was shipped to the Paris Exposition on the steamer Bordeaux, which sailed on the 22nd inst. In general, the locomotives conform to regular practice of American builders. The gage, however, is 5 ft., the engines are lighted by the Pintsch gas system from reservoirs which are carried under the tender, and the Latowski steam bell, Dewrance water gages and Sirius injectors are used. In Fig. 1 the general appearance of the locomotives is readable. In Fig. 2 various elevations and sections show the locomotive structure. The general description of parts, main dimen-

sions, and materials used, are given in the following table of descriptive specifications:

DESCRIPTIVE SPECIFICATIONS.

General Dimensions.

Gage	5 ft. 0 in.
Fuel	Coal
Weight on drivers	85,000 lbs.
" in working order	90,000 lbs.
Wheel base, driving	12 ft. 6 in.
" total engine and tender	39 ft. 11¼ in.
Total length of engine and tender	50 ft. 9½ in.

Cylinders.

Diameter	16 in.
Piston stroke	24 in.
" packing	Cast iron
" rod, 2¾ in.	Steel
" " packing	U. S. Metallic
Steam ports	1¼ x 15 in.
Exhaust ports	2½ x 15 in.
Bridge width	1 in.

Slide Valves.

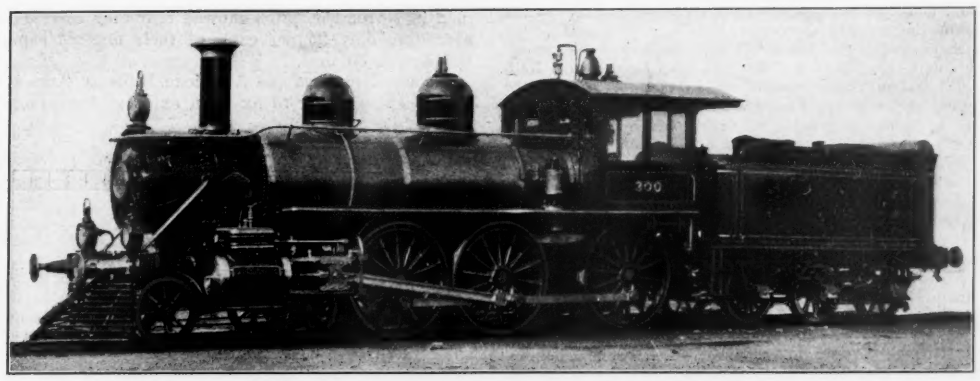
Style	American balanced
Greatest travel	5¼ in.
Lap, outside	⅞ in.
" inside	0
Lead in full gear	1-32 in.
Valve stem packing	U. S. Metallic

Wheels.

Driving, number	6
" diameter	62 in.
" centers	cast steel
" boxes	cast steel
" axle journal	6½ in. x 8 in.
Engine truck, style	Center bearing, swing motion
" wheels diameter	33⅛ in.
" " centers	wrought iron
" axle	steel
" journals	4½ x 7½ in.

Boiler.

Type	Straight top, radial stayed
Working pressure	180 lbs.
Outside diameter, 1st course	52 in.
Thickness of plates in barrel	½ in.
" " roof and sides	½ in.
Seams, circumferential	Double riveted
" horizontal	butt sextuple riveted
Fire-box, length	56¾ in.
" width	37 in.
" depth	front, 68¼ in.; back, 67 in.
" material	copper
Fire-box, plates	sides, ½ in.; back, ½ in.
" plates	crown, ½ in.; tube, ½ and ⅝ in.
" water space	front, 4 in.; side, 3 in.; back, 3 in.
" crown stays	1⅛ in. "Brown," iron
" stay bolts	1⅛ in., copper
Tubes	material, brass and copper; length, 151⅝ in.
"	number, 170; diameter, 2 in.; thickness, Nos. 12 & 15
Heating surface, tubes	1,114 sq. ft.
" " fire-box	80 sq. ft.
" " total	1,194 sq. ft.
Grate	style, wrought iron; C. iron dump
" area	15.2 sq. ft.
Exhaust pipe	style, single
" " nozzle	3, 3¼ and 3½ in.
Smokestack, inside diameter	15¾ in.
" " top above rail	13 ft. 5 in.



Richmond 10-Wheel Locomotive—Finland State Railroads.

Tender.

Weight, empty	27,000 lbs.
Frame	Steel
Wheels	number, 6; diameter, 37 in.
Journals	steel, 4 in. x 8 in.
Wheel base	9 ft.
Tank capacity, water	2,100 gals.
" " coal	5 tons

The Trans-Siberian-Manchurian Railroad.

This great scheme formed the subject of a paper read and discussed before the Royal United Service Institution in London, on June 7. From an abstract in the London *Times* we gather that Mr. Archibald R. Colquhoun, who read the paper, said:

That the stupendous conception of a Russian Pacific railway was not from the beginning grasped in its entirety. It was but gradually that the idea was conceived of that unparalleled achievement to which the Imperial rescript of March 17, 1891, gave birth. In course of construction the line had become much changed in character. No longer a purely internal enterprise—running through unknown territories to terminate at an obscure Russian port far away in the north—by the Manchurian alignment it had become the world's highway from west to east, a route which was to bring the vast empire of China for the first time into inti-

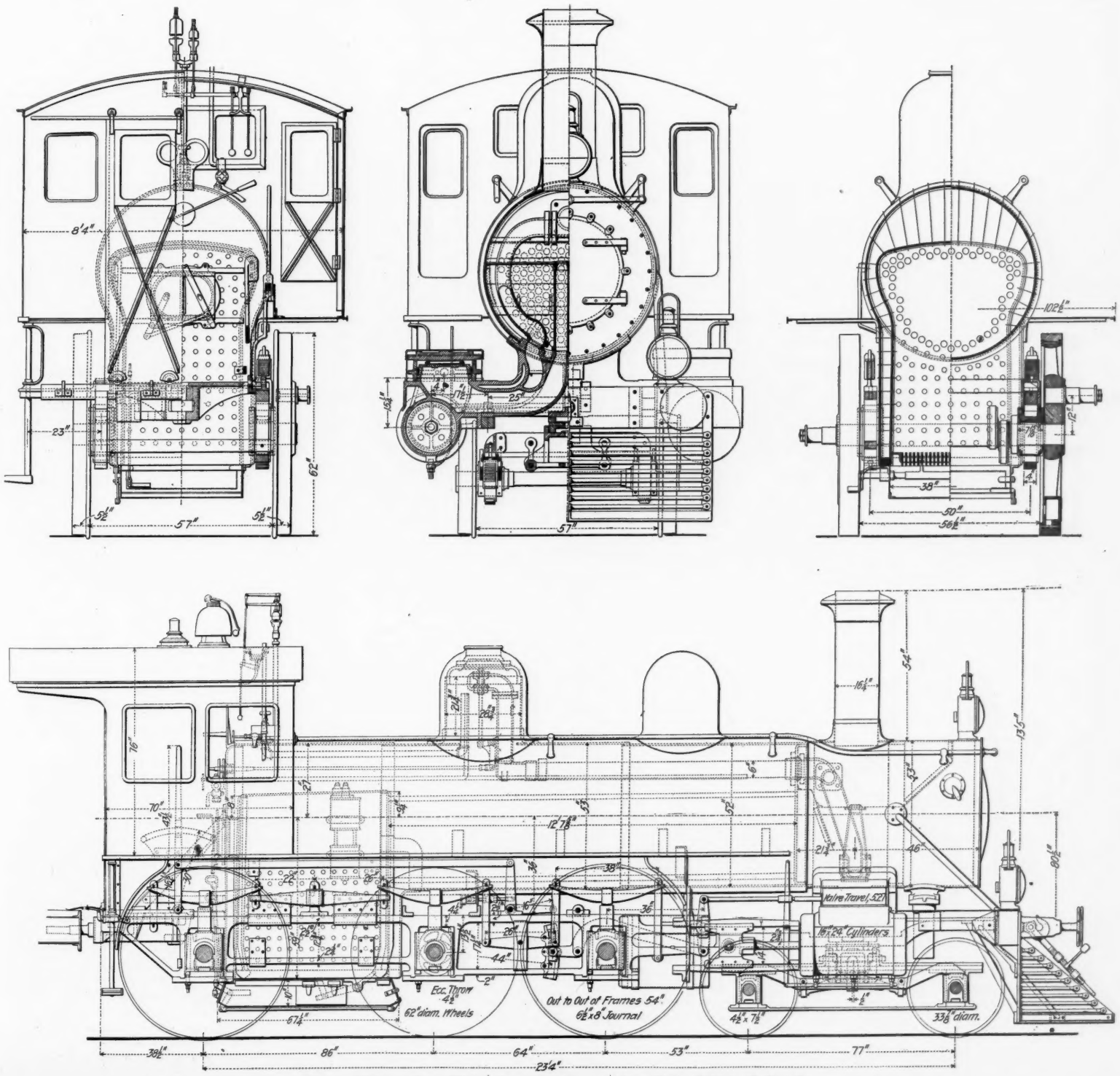


Fig. 2.—Richmond 10-Wheel Passenger Locomotive—Finland State Railroads.

mate touch with Europe. From a merely domestic work, the railway had become a great international undertaking and had passed into the domain of foreign affairs. It promised to develop into one of the greatest arteries of traffic the world has yet seen and into a political instrument whose far-reaching effects it was difficult to gauge. The work already accomplished had all been done within the time calculated, the estimate not having been exceeded in any of the sections as yet opened, and it was as certain as any such calculations could be that the time limit for the remainder of the operations, i. e., 1902, would not be exceeded. That year would see the whole system in working order, and then Russia would be ready for her great coup. If the original financial estimates had been exceeded, that was the affair of the Russian Government.

In sheer length the Trans-Siberian Railway would be almost double that of the Trans-American Continental Railway. Leaving Trans-Baikalia and Manchuria out of the question, the Siberian line was an exceptionally easy one from an engineering point of view. Much attention had been given to the bridges, of which there were many. The big ones were all of the same type, being constructed of iron with stone piers supporting spans which in some cases measured as much as 100 yards in length. In point of actual construction the Siberian maximum was far behind the American one, though in the circumstances it was fast. Six versts, or three miles and three-quarters, a day was the highest rate ever reached by the Russians. But while the Americans took nearly seven years to complete a distance of 1,800 miles, the Russians covered nearly 1,000 miles more in less than eight years. During the greater part of the construction no less than 150,000 laborers were employed, but the labor question was saved from developing into a problem by the exceptional character of the Russian peasantry who did not object to being moved from one place to another.

The general plan, though in itself excellent, had been badly worked out in detail. The Russian-European engineers, quite unused to mountains, often avoided easy slopes along the hills, and carried the line through marches where solid foothold was difficult to obtain, and where the line must be continually subject to inundations. The want of solidity in the low-lying sections was the only problem of any difficulty that had to be faced, before reaching Lake Baikal, and the solution of the difficulty found by the engineers redounded but little to their credit. The disasters which had occurred were mainly due to this. In the Stretensk section the spectacle of three miles of rails afloat on the sleepers being carried down stream had been seen. In the section beyond Baikal the difficulties would be greatly increased. Many of the sections of the permanent way would have to be relaid, and most of it was insufficiently ballasted. As at present constructed, the lines would be incapable of supporting a continuous or heavy train service, and it was indeed proposed to lay down heavier metals. In 1898 £10,000,000 were voted for the improvement of the permanent way in the western half of the line, although it was only just completed. Bad material had often been ordered, and there continued to be a great deal of barbaric waste. The present intention was to relay the whole of the Central and Trans-Baikalian sections with heavier rails, to replace 1,429 wooden bridges with stone and iron ones, to construct 91 additional sidings, and to ballast the greater portion of the permanent way. It was hoped by this means that a maximum speed of 33 miles an hour for passenger trains would be attained. The cost of the line would greatly exceed the original estimates of £38,000,000.

Thus was Russia entering into possession in Asia, and paralyzing the vital centers of the Chinese Empire which her "destiny" would later on force her to absorb. Under the cloak of legitimate effort Russia had again secured the world's approval, and had retained it until the matter had gone too far for other powers to do anything.

The Most Economical Size of Freight Cars.*

BY L. F. LOREE.

American railroads began with small freight cars, following the examples set by the engineers of the Old World. With the rapid increase in wealth beginning in 1849, there was a great expansion in railroad construction, and this expansion, though checked for four years by the Civil War, has continued, until we have the enormous development of to-day. In the early days food and fuel were procured near the places where they were needed; now Eastern states get their flour from west of the Mississippi, and their beef fresh from Kansas City. This development of commerce has necessitated corresponding improvements in the railroad service. The original four-wheel freight car carried 7,000 lbs.; by 1860 four-wheel coal cars were made to carry five tons and eight-wheel cars for merchandise carried about the same weight. Even down to 1865, 15,000 lbs. was the ordinary maximum load for a box car. In 1873 the standard box car weighed 18,700 lbs., and had a capacity of 28,000 lbs. In 1875 coal cars, with hopper bottoms, weighing 18,750 lbs., were made to carry 37,000 lbs. of coal. The 20-ton car (40,000 lbs.) was introduced in 1876, the 25-ton in 1883 and the 30-ton in 1885. These sizes became successively the standards for all classes of freight cars on the principal roads. In 1895 the Pennsylvania lines west of Pittsburgh built a large number of 35-ton cars for carrying coal and ore, and some 40-ton box cars. The 50-ton car, made of steel, is now common for coal and ore, and some box cars of that capacity are being built. It is now customary to load cars with 10 per cent. more than they are rated at, so that we have cars which carry about three times their own weight. The 40-ton car weighs 18 tons, and the 50-ton weighs 19¼ tons. The latter, when loaded at 110 per cent. of its capacity, weighs, with lading, 148,500 lbs., so that the weight of the car is less than 26 per cent. of the total.

* From a paper prepared for the International Railway Congress by Mr. L. F. Loree, General Manager of the Pennsylvania Lines West of Pittsburgh. Printed in the Bulletin of the Congress, Vol. XIV., No. 5, May, 1900.

On July 1, 1898, the railroads of the United States owned 1,278,189 cars and individuals owned 115,040; total, 1,393,229. Of these cars box or closed cars constituted 55 per cent. Of cars more than 36 ft. long, or carrying over 30 tons, Mr. Loree reports 28,985, of which 16,974 were furniture cars. He goes on to explain how these cars of large cubic capacity were built for the purpose of juggling with the freight rates, and notes that 10 tons of grain cradles would require a car 300 ft. long. He says that these large furniture cars are unwieldly, somewhat dangerous and are unprofitable. A record of 314 such cars, moved on a certain road in November, 1898, showed that they carried loads averaging only 25 per cent. of their marked capacity, which was 30 tons.

A committee from the American Railway Association is now endeavoring to fix upon extreme dimension lim-

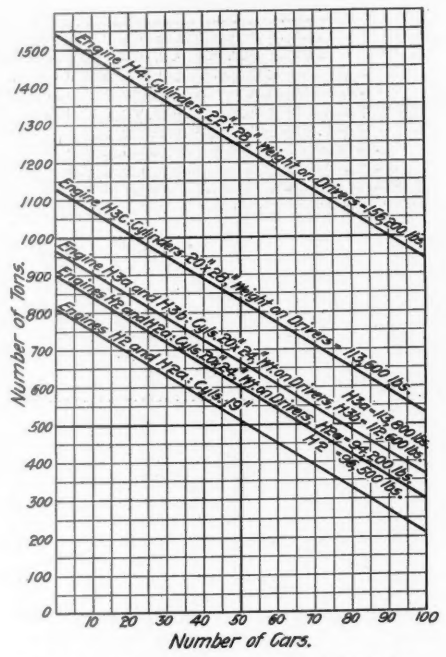


Fig. 1.—Engine Rating—Erie & Ashtabula.

its for closed merchandise or box cars, and it is thought that by concerted action of the Traffic and Transportation Departments of the lines, the building of the special furniture cars can be stopped. The great railways are being compelled under existing transportation conditions to sink their individuality, so far as freight cars are concerned, and must build cars that will pass freely from one section of the country to another, and from one line to another; and the height and width are limited, not by theory, but by the physical limitations of clearance of important railroads.

On the question whether it is profitable to build box cars to carry more than 30 tons, Mr. Loree says that the 40-ton car (34 ft. long) weighs 3,000 lbs. more than a 30-ton car of the same length, and costs $47.60 more, which is equal to $3.13 less per ton of carrying capacity.

"It is objected that the greater light weight means greater cost of moving the car, but if we analyze the cost of moving the 3,000 pounds greater weight, we have:—

"Average mileage of box cars per year, 10,000 miles; average weight of box cars, 16 tons; average weight of paying load, 10 tons; average cost of transporting paying load per ton-mile, 4 mills; cost of moving car and lading per mile, 40 mills; 40 mills divided by 26, 1.54 mills per ton; 1½ tons added dead weight, 10,000 miles, 15,000 ton-miles; 15,000 ton-miles × 1.54 mills = $23.10, cost per year to haul the additional dead weight.

"If we assume an average receipt per ton-mile of 5.36 mills, and the cost, as above, at 1.54 mills, the net revenue from any additional freight hauled in such car would be 3.82 mills per ton-mile; and to pay for the cost of moving the extra dead weight we must carry 6,000 tons of paying load (2310 ÷ .382); and as an 80,000 lbs. capacity car will load at least seven tons more than a 60,000 lbs. capacity car, one trip of 857 miles (6,000 ÷ 7) each year, with additional load, would compensate for hauling the extra dead weight of 1½ tons the entire year.

"As a matter of fact these cars can be and have been loaded with 88,000 lbs. of grain at the elevators on the Mississippi River and carried to Baltimore, Philadelphia and New York; the capacity of the yards and terminals is increased by the use of such a car 33⅓ per cent. over the 60,000 lbs. capacity car. Trade rules at the large commercial centers may have to be changed to enable the full utilization of such cars, but this will be done or the grain trade will pass around such centers."

Mr. Loree next describes the improvements which have been made at Cleveland and Pittsburgh and thereabouts to make it possible to carry coal and ore at very low rates. More than half the ore which comes from Lake Superior is loaded direct into cars for Pittsburgh without being stored at the docks. A careful record of nearly 200,000 cars running between Pittsburgh and Lake Erie showed that those carrying ore were loaded with 108 per cent. of their marked capacity, and those carrying coal with 82 per cent. And these appear to have been mostly 35, 40 and 50-ton cars. This proves that in that kind of service it was true economy to build cars to carry more than 30 tons.

The advantages gained by reducing the length of train for a given tonnage, which are secured by the use of large capacity cars, are:—

"First: That the friction and atmospheric resistance are lessened, and by bringing the moving load closer to the locomotive it can be handled with greater ease.

"Second: A less number of cars and locomotives is required to move a given tonnage, saving interest on capital and car service, and lessening the empty car movement in the direction contrary to the heavy traffic movement.

"Third: The necessity of increasing the capacity of the main lines, freight yards and shops is avoided, and at the same time the cost of switching is reduced.

"Fourth: A large saving in wages results from the decreased number of trains.

"It is largely by these means that the railways have been able to reduce the cost per ton-mile to a figure thought to be impossible several years ago."

To show the increase in tonnage made possible by decreasing the number of cars Mr. Loree has prepared the diagram shown in Fig. 1, which was made to show the power of certain engines on 1 per cent. grades on the Erie & Ashtabula Division of the Pennsylvania lines west of Pittsburgh. The weights and cylinder dimensions of the engines are shown on the diagram. The rating is based on a speed of eight miles an hour.

The paper is supplemented by an appendix filling about 90 pages. The first 25 pages give answers, made by about 20 different railroads, to a series of questions put to them concerning a great variety of features in connection with the use of freight cars. Nearly all of the companies answering these questions are important lines, doing a large freight business. The rest of the appendix consists of tables giving the dimensions, weight and other particulars of all classes of cars on the different roads, each road appearing in a separate item in the table. Each table has 32 columns; and 30 different classes of cars are shown. Another table gives for 1880, 1890 and for several years since then a classification of the entire freight equipment of each company, according to the capacity of the cars. A summary of these data on (for example) the Pennsylvania lines west of Pittsburgh, shows that in 1880 the system had 25,545 cars with an aggregate capacity of 397,052 tons (average per car 15.6). In 1897 the same system had 78,487 cars with a total capacity of 2,061,115 tons (average 26.6). In a similar compilation it is shown that on the same system of roads in 1894 37 per cent. of the car mileage was empty; that the average load per loaded car was 13.51 tons, and the average load per car (all cars moved) was 9.11 tons. In 1898 the empty car movement was 37 per cent., average load per car 15.56 tons, average load, all cars, 10.85 tons.

Fires Set by Locomotives on the Road.*

A recent publication is authority for the statement that the locomotives of America burn each year over fifty million tons of coal. Of this amount it is estimated that not less than two and one-half million tons pass out of the stack in the form of cinders, and are lost. Great as this loss is, it is unavoidable, for the process by which the locomotive is made to yield its power is one of unusual activity.

Not only is the cinder a source of expense to railways through the loss of fuel it occasions, but it continues to menace their welfare, even after leaving the stack. Every year immense forest fires devastate the country, sometimes wiping out entire towns and destroying millions of dollars' worth of property. And such fires are often, justly or unjustly, ascribed to sparks from locomotive stacks.

Opinions differ as to the exact limits within which there is danger of fire from a passing locomotive. Those best qualified to judge say that beyond 100 ft. from the track the danger is slight. But, on the other hand, testimony is not infrequently given by which it is sought to show that fires may be set half a mile distant from the track.

The investigation, the results of which are presented in the thesis, was undertaken by Charles Ducas, in co-operation with J. B. Dill, for the purpose of obtaining some exact data concerning the danger of fire at different distances from the center of the track.

The investigation was a two-fold one, dealing first with some theoretical considerations, and secondly with observed data obtained from along the right of way and its immediate vicinity.

A series of tables has been computed, showing the distance that will be traversed by a free falling body when projected upwards to different heights and when acted upon by wind of different velocities. But a cinder is a body comparatively light. Hence an allowance must be made for the atmospheric resistance. To secure a measure of this, some special apparatus was designed, and from results thus obtained other tables were constructed taking this factor into consideration. The significance

*An abstract of a thesis by Charles Ducas and J. B. Dill, Jr. Presented by the former as a commencement part. Purdue University, June 6, 1900.

of this phase of the problem appears in the following illustration: Suppose a cinder be sent from a stack to a maximum height of 30 ft. when the wind blows across the track at a velocity of 20 miles per hour. If the atmospheric resistance be neglected, the cinder may be assumed to fall at a distance of 68 ft. from the track. Whereas, taking the resistance into account, it will be found to fall at a distance of 34 ft. from the track.

The experiments along the right of way were conducted at the top of a grade on the Lake Erie & Western, at a point about two miles west of the Lafayette station.

The method of procedure was as follows: A number of metal pans about 2 ft. square were placed in a line at right angles to the track; the first 15 ft. from the center of the track, the second 25 ft., the third 35 ft., and so on, the last in the series being 350 ft. from the track.

A layer of cotton in the bottom of each pan served to retain cinders which otherwise might have been blown away by the wind, and to indicate by a scorched mark on the cotton the degree of heat in the cinder. The time of the experiments was chosen when the wind blew at right angles with the track and in the direction of the line of pans.

While the train was passing observations were taken showing the speed of the train, velocity of wind, type of locomotive, number of cars in trains and the character of smoke. A photograph of the passing train was also taken. When the train had passed the cinders in each pan were carefully collected, placed in separate bottles and labeled. By afterward weighing the contents of the several bottles a rather definite estimate of the distribution of cinders along the right of way was obtained.

Among the results derived from such a process, many times repeated, it will be of interest to note that under the influence of the comparatively cool atmosphere of April and May heat effects were in no case sufficient to scorch the cotton; also that the greatest number of cinders fell at 75 ft. from the track, though the distance of maximum volume varies, as would be expected, with the velocity of the wind. Cinders found at greater distances than 100 ft. from the track were in all cases so small as to preclude any possibility of fire from their action.

In addition to the tables already mentioned, the thesis contains:

1. The results of the tests on atmospheric resistance to the motion of falling cinders.
2. A map and profile of the railroad in the vicinity of the point from which the observations were made.
3. Results of observations along the right of way.
4. A formal estimate as to danger from fire.

The Transportation Show at Paris.

A recent issue of the *Journal des Transports*, of Paris, contains the first of a series of articles on the transportation exhibits at the World's Fair. Much space has been devoted to this class of exhibits; an international station is established at Vincennes, covering an area of about 21,560 square meters. The station is a series of halls about 200 meters long and 120 meters wide. There are shown about 60 locomotives, most of them being large machines, and also more than 200 cars of various kinds. "Side by side with our great companies and our state railroads (very largely and appropriately represented) the United States is there with its remarkable wagons, its practicable and comfortable luxury and with six examples of its colossal and renowned locomotives; Austria with seven engines, Germany with six locomotives and with splendid carriages, bearing well-known names, which are real revolutions in the science of locomotion. Russia, which shows five carriages, attracts attention by the magnificence of the material and the finish of the construction, undeniable evidence of an astounding industrial progress." Switzerland shows among other engines an electric locomotive for working rack railroads, which is sure to attract much attention. The French locomotives are seventeen in number.

Around the international station are installed signals and various apparatus for protecting trains used by the great French companies and by the foreign roads. A German establishment is in operation injecting ties for preservation, and near by one may see a section of the Barmen-Elberfeld suspended electric tramway and a section 50 meters long of a Temperly transporter (called by our French contemporary Kimperley). Here may be seen also brakes, couplers, axles, wheels, switches, crossings, etc.

The visitor will not fail to notice one of the first of Stephenson's engines exhibited by the Western Railroad Company of France. The French companies show charts, plans and profiles setting forth the stages of their development.

"This exposition is the triumph of the compound locomotive and the American car. The long car with bogie trucks, so much criticized among us for 20 years, is no longer a novelty, and now the time of experiment is past." All of the great French companies now use long cars with bogie trucks and corridors for intercommunication.

But the French writer seems to be particularly struck by the number of compound engines shown. "The colossal machine shown in the Russian section seems to be only a Mallet compound locomotive, with two trucks and four cylinders." Germany shows a triple expansion engine in which the problem of condensation is courageously attacked. Finally, the electric locomotive is in force. The Paris, Lyons & Mediterranean shows its storage battery engine, and the Orleans its Thomson-Houston trolley locomotive. This latter company makes the most impressive electrical exhibit by the mere fact of putting in operation its city line, underground and worked by electricity.

The American Bridge Company.

The American Bridge Company have issued the following circular letter to the trade: "It has been deemed expedient to organize the American Bridge Company, incorporated for the purpose of designing, building and erecting bridges and all classes of metallic structures. The facilities at our disposal are such that we shall be able to give you the advantage of favorable quotations and be enabled to avoid delays in delivery." Accompanying this is a list of the various bridge companies forming the consolidation, which we have printed before, but repeat:

American Bridge Works, Chicago, Ill.
Berlin Iron Bridge Co., East Berlin, Conn.
Buffalo Bridge & Iron Works, Buffalo, N. Y.
Carnegie Steel Co. (Keystone Plant), Pittsburg, Pa.
Edge Moor Bridge Works, Wilmington, Del.
Elmira Bridge Co., Elmira, N. Y.
Gillette-Herzog Mfg. Co., Minneapolis, Minn.
Groton Bridge & Mfg. Co., Groton, N. Y.
Hilton Bridge Construction Co., Albany, N. Y.
Horseheads Bridge Co., Horseheads, N. Y.
Lafayette Bridge Co., Lafayette, Ind.
Lassig Bridge & Iron Works, Chicago, Ill.
New Jersey Steel & Iron Co., Trenton, N. J.
New Columbus Bridge Co., Columbus, Ohio.
Pittsburgh Bridge Co., Pittsburgh, Pa.
A. & P. Roberts Co. (Pencoyd Iron Works), Pencoyd, Pa.
Post & McCord, Brooklyn, N. Y.
Rochester Bridge & Iron Works, Rochester, N. Y.
Schultz Bridge & Iron Works, Pittsburgh, Pa.
Shiffler Bridge & Iron Co., Pittsburgh, Pa.
Union Bridge Co., Athens, Pa.
Milwaukee Bridge Co., Milwaukee, Wis.
Wrought Iron Bridge Co., Canton, Ohio.
Youngstown Bridge Co., Youngstown, Ohio.

"These companies have a combined capacity of 600,000 tons per annum. The Pencoyd plant also comprises one of the best and most complete rolling mills for structural material in existence, with a capacity of 200,000 tons per annum. This puts the American Bridge Company in a position to furnish all classes of bridge and structural work at a minimum of cost, and in the shortest possible time. No advance in prices will be made, but the cost of production will be reduced to a minimum.

"The majority of the Board of Directors are practical bridge men who have made a success of their individual companies. The financial end is unusually strong, being represented by firms and institutions of world-wide financial strength; thus forming a combination of practical and successful bridge men, backed by the strongest resources. The executive organization is made up entirely of men of large practical experience, headed by Percival Roberts, Jr. Joshua A. Hatfield has been appointed as Assistant to the President, and will also have charge of the sales of the rolling mill products of the Pencoyd plant.

"The engineering department is in charge of Mr. Charles C. Schneider, with the title of Vice-President, in Charge of Engineering. Mr. Schneider has full charge of all questions of engineering, including the preparation of all plans, estimates and working drawings. All engineers of the company, whether engaged in the contracting, operating or erecting departments, are under him. At different localities throughout the country are stationed corps of designing engineers to prepare preliminary plans and estimates, and at each plant will be a corps of engineers and draughtsmen to prepare plans for the work made at that particular plant.

"The operating department is in charge of Mr. Charles M. Jarvis, with the title of Vice-President in Charge of Operating. As soon as contracts for any work are taken, they are immediately turned over to this department for execution, and consequently all the plants and erecting forces of the company belong in this department. At each plant is a manager, with charge over employees and the operations of that particular plant. Where a number of plants are closely located, they are placed under one local manager, each plant having a superintendent. All managers are under the direct charge of a General Manager, Mr. James P. Kennedy, formerly President of the Youngstown Bridge Company. The erecting is also in charge of the operating department, and this is under Mr. William Wennas, as Superintendent. Mr. Wennas has had full charge of all the Pencoyd erecting for a number of years, and gained a world-wide reputation for the economical and expeditious manner in which he handled the erection of the famous Atbara bridge.

"All the sales of the Company are in charge of the contracting department. This is divided into three distinct parts: Railroad Contracting, Highway Contracting, Structural Contracting. The railroad contracting is in charge of Mr. Charles Macdonald. The highway contracting is in charge of Mr. Frank Conger, and the structural contracting is in charge of Mr. W. H. McCord. The preparation of all proposals and contracts is in charge of this department. The company has opened contracting offices in different parts of the country, each office reporting daily, by wire, to various members of the contracting department. In the contracting department are made up the proposals and estimates on all work.

"The mechanical department has been placed in charge of Mr. James Christie, with the title of Vice-President. The mechanical details of all the various plants belong to this department, and the selection of Mr. Christie insures a mechanical equipment that will guarantee the production of a pound of finished bridge material at the minimum expenditure of power.

"The financial department is in charge of Mr. William H. Connell, as Treasurer, with Mr. F. M. Wyant and Mr. F. H. Schmidt as Assistant Treasurers. The Auditor is Mr. Charles C. Price, formerly with the Pencoyd Works.

"The purchasing department is in charge of Mr. Francis W. Heisler, formerly Purchasing Agent for Edge Moor, with headquarters at No. 259 South Fourth street, Philadelphia, Pa. The Assistant Purchasing Agent is Mr. E. A. Muench, formerly Purchasing Agent for the A. & P. Roberts Company. The Secretary of the Company is Mr. Douglas O. Morgan, formerly a member of the law firm of Seward, Guthrie & Steele."

Superior Extras vs. Schedule Trains.*

Mr. Mackie began with a reference to a plan recently proposed by Mr. George Spencer, of the Canadian Pacific, for making extra trains in the ruling direction always superior to those in the opposite direction. An extra train in the inferior direction, on meeting an extra (carrying a white flag), would always assume that another extra was following the white flag, and therefore proceed only after getting an order from the Dispatcher. Mr. Spencer would connect his extras by mentioning them in train orders (when running in the superior direction) thus, "Extra 798 by 443," meaning that Extra 443 carried a flag for 798. Under this plan a ruling extra would not need to receive information of opposing extras until near the meeting point.

Mr. Mackie, without either approving or condemning this plan, proposes other ways of attaining the same end. First, he suggests dividing a division into two districts, so that in sending out an extra which must meet other extras on the road the Dispatcher will not be tempted to specify a large number of meeting points in the first order. The number of running orders would then be greater, but the liability to error would be reduced, and there would be less likelihood that a meeting point once made would subsequently have to be changed.

But another plan, and one which Mr. Mackie appears to deem the best, is to have plenty of schedule trains in the superior direction, and then run all freight trains which are to be moved in that direction, as sections of a regular train; and in the opposite direction he would run every freight as an extra, except those which are pretty sure to always run on time. With five schedule freights in the ruling direction every 24 hours there should be no trouble, as the Dispatcher usually has 6 hours' notice of any train likely to be run. A regular train could be annulled if there were no business in sight for it.

Mr. Mackie's experience teaches him that the fewer schedule freight trains in either direction the better. Still, the plan just noted, of having all freights in one direction run on schedule rights, would facilitate train movement and relieve the Dispatcher of the most serious liability to error which he is subject to—the liability to overlook an extra in making a meeting point.

Mechanical Bells as Duplicates of Visual Signals.

Mr. L. Weissenbruch, of the Belgian State Railroads, has an article in the Bulletin of the International Railway Congress for April telling of the present practice in Europe in this matter. Torpedoes are a serviceable expedient where fogs occur occasionally, but where the obscuration of the visual signals is common or constant a bell at once suggests itself. The Regnault alarm, which was at one time used on the Western of France, was given up because so much battery power was required in order to make the bell sound loud enough. There are in use in Germany the Hattemar system, made by Lorenz & Co., of Berlin, and the Siemens apparatus. The former is worked by electric power and the latter by clock work. There are three kinds of apparatus in use in England, the Lopes, made by Sykes, one made by the Fazakerley Signal Co., and one made by the London & Northwestern.

Remarking that the problem here is identical with that of giving warning at a highway grade crossing that a train is coming, Mr. Weissenbruch mentions highway crossing bells in use in France; the Forest, Lartigue & Digney and the Sartiaux. The London & Northwestern, at places where it has electric motors in use for other purposes, has put in bells to be worked by such motors.

Mechanical appliances for obtaining motive power entirely from the movement of trains are objectionable, because, being subject to the action of all passing trains, they soon get out of order.

Audible signals of the nature of those mentioned have been in use for many years in Germany and in England, but have seldom been described. The paper then goes on to describe an apparatus made by Bruchlas, which is in use at Hochspeyer, on the Palatinate railroads (Bavaria). This has been in use 10 years. The treadle is not acted upon by the wheels when the signal is off.

All the English bells found by the writer are inside of tunnels. He mentions tunnels on the Great Northern, the Lancashire & Yorkshire, the Great Central and the London & Northwestern.

The three or four drawings given with this article show nothing novel.

*Abstract of a paper by J. F. Mackie, read at the meeting of the Train Despatchers' Association at Atlanta, June 13.

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EDITORIAL ANNOUNCEMENTS

CONTRIBUTIONS—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussion of subjects pertaining to ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

ADVERTISEMENTS—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

The lease of the Fitchburg Railroad to the Boston & Maine is at last an accomplished fact. The long discussion in the Massachusetts legislature over the bill approving this lease appears to have had no very intelligent purpose and no result except delay, as the approval of the Governor, which was given several months ago, made it clear that it was for the interest of the State—which was a stockholder—that the road ought to be joined to some larger company. In making an alliance with the Boston & Maine, the Fitchburg directors have undoubtedly done the best thing that could be done. The prospective absorption of the Boston & Albany by the New York Central threatened to take away some of the Fitchburg's business—and, indeed, it is likely that it will take a good slice in any event; but the Boston & Maine controls some little share of this business—that coming by rail from east of Boston—and this share will be partly saved. The Boston & Maine, paralleling the Vanderbilt line to a point 20 miles west of Albany, will be able to make better terms with it on through rates than if the only connection were at Boston. These seem to be the only "strategic" features of the bargain. The Fitchburg, however, should be a profitable property in itself; and the Boston & Maine now gets complete control of all the valuable railroad terminals on the north side of Boston. Judging solely by the railroad map, that city now comes perilously near being a way station—on one railroad. She has our sympathetic commiseration.

Station Stops With Side Doors and With End Doors.

In 1894, in the course of a somewhat elaborate study of the differences between the metropolitan railroads of New York and those of London, we took up the matter of the length of station stops and the effect on that element of side doors and end doors for the cars. Our average figure for the time consumed in the stop was derived from observations, watch in hand, and compared with official records. We concluded that a fair average time, from full stop to start, at the stations of the London Underground was 30 seconds, the range from the shortest to the longest stop being considerable. We found that on the elevated railroads of New York the average stop would be somewhere between 12 and 15 seconds, and indeed, as we remember, the late Col. Hain said that it was somewhat less than 14 seconds. Yet the cars of the Manhattan Elevated have end doors and the cars of the London Underground have side doors, and theoretically, the latter should receive and discharge passengers more promptly than the former. Practically, however, the matter works out the other way, and a little study from actual observation in the field shows why it should; that is, there is no real conflict between theory and practice, which we generally find to be the case when we get enough knowledge.

The British and continental passenger car, with compartments entered by side doors, can be emptied quicker than the American car with end doors, and it is quite possible that at a terminal station the passengers could be handled quicker in a side door car than in an end door car, taking the sum of the time occupied in emptying the car and then filling it again. At way station stops, however, the matter is quite different. With the end doors the passengers step on the platform of the car, and the matter is settled, so far as the station stop goes. The train can be started immediately and the passengers distribute themselves after the train has started. With the side door cars the passengers look for a compartment of the class for which they hold tickets, and having found their proper class they look further for a seat which suits their notions of comfort. In other words, they must assort and distribute themselves while the train is still standing at the station and not after it has got under way. This, we take it, is the main reason for the longer, and necessarily longer, station stops of side door cars.

Another reason, however, which seemed to act on the London Underground railroads is that the side doors must be closed by the guards, but, as we observed, the guards ran alongside the trains and shut the doors after the trains were under way. So, perhaps this element is not of much importance. Still another element may be the habit to which our people are educated of moving quickly. The average Briton would probably feel indignant at being told to "step lively," and would be more likely to retard than to accelerate his pace under such an injunction, and in fact the self-respecting American could hardly blame the Briton for feeling that way.

Quite recently we have received from Mr. R. H. Soule some notes giving the results of observations made by him when daily using the suburban service of the Cape Government Railways out of Cape Town, South Africa, in the winter (their summer) of 1897 and 1898, and also some observations which he made when using the suburban service of the Illinois Central Road out of Chicago in the summer of 1899.

The length of time elapsed between stopping at and starting from local stations was noted in 100 cases on each road; on the Cape Government road between Cape Town and Wynburg, and on the Illinois Central between Chicago and Hyde Park, the distance being seven miles in each case. The results expressed in averages were, Cape Government Railway, 22.39 seconds; Illinois Central Railroad, 11.58 seconds; the ratio of these two periods of standing at stations is as 100 to 52, but it would not suggest exaggeration to speak of it as 2 to 1.

The Cape Government cars have transverse compartments with side doors, but the cars have no end doors. The Illinois Central suburban cars are not subdivided into compartments, but are the regular American pattern, and have end doors and platforms, the latter being carried out flush to the sides of the car. The Cape Government road is equipped with high platforms, on the same level as the car floor, at all stations, and the Illinois Central has such high platforms at its suburban stations out of Chicago, where these observations were made.

The reasons for the better results with the American cars Mr. Soule believes to be several. The passengers assemble at the ends of the car before the train actually comes to a full stop, and are ready to step off at once. In the English cars it is dangerous to open the side doors, which swing outwards, until the train comes to a full stop. When the side doors are once opened, however, the compartments discharge themselves very quickly, but the public will not close the doors of the vacated compartments, which must be done by the train guards and station porters; and the train cannot start again until all or nearly all of the doors have been closed. In loading passengers into an English car there is also a considerable loss of time, owing to the fact that people have a preference for corner seats next the windows and will look into several compartments before making a selection and entering one.

This comparison is made, it will be noticed, under similar and comparable conditions, and shows that the American system requires only half as much time for station stops as the English system.

May Accidents.

Our record of train accidents in May, given in this number, includes 88 collisions, 134 derailments and 9 other accidents, a total of 231 accidents, in which 46 persons were killed and 132 injured. The detailed list, printed on another page, contains accounts only of the more important of these accidents. All which caused no deaths or injuries to persons are omitted, except where the circumstances of the accident as reported make it of special interest.

These accidents are classified as follows:

Collisions.	Rear.	Butting.	Crossing and other.	Total.
Trains breaking in two	16	0	1	17
Misplaced switch	1	0	3	4
Failure to give or observe signal	6	3	2	11
Mistake in giving or understanding orders	0	3	0	3
Miscellaneous	1	0	13	14
Unexplained	14	2	23	39
Total	38	8	42	88

Derailments.			
Loose or spread rail	2	Misplaced switch	11
Defective bridge	5	Bad switching	2
Defective switch	2	Bad loading	1
Soft roadbed	1	Too quick application of airbrakes	1
Broken wheel	9	Runaway	2
Broken axle	7	Failure to give signal	1
Broken truck	4	Unfastened switch	1
Fallen brake beam	2	L'motives left unattended	1
Failure of drawbar	2	Unattended	1
Failure of drawbar and automatic application of airbrakes	1	Animals on track	3
Automatic app. airbrakes	2	Landslide	3
Brake chain failure	1	Washout	5
Loose wheel	1	Malicious obstruction	3
Loose tire	1	Accidental obstruction	1
Loose pilot	1	Unexplained	58
			134

Other Accidents.	
Boiler explosion	3
Cars burned while running	4
Other causes	2—9
Total number of accidents	231

A general classification shows:

	Collisions.	Derailments.	Other acc'd'ts.	Total.	P. C.
Defects of road	0	10	0	10	4
Defects of equipment	18	31	3	52	23
Negligence in operating	31	20	4	55	25
Unforeseen obstructions	0	15	2	17	6
Unexplained	39	58	0	97	42
Total	88	134	9	231	100

The casualties may be divided as follows:

	Collisions.	Derailments.	Other acc'd'ts.	Total.
Killed:				
Employees	9	23	4	36
Passengers	0	1	0	1
Others	3	6	0	9
Total	12	30	4	46
Injured:				
Employees	32	52	2	86
Passengers	9	18	3	30
Others	3	13	0	16
Total	44	83	5	132

The casualties to passengers and employees, when divided according to classes of causes, appear as follows:

	Pass. killed.	Pass. injured.	Emp. killed.	Emp. injured.
Defects of road	0	0	4	6
Defects of equipment	0	2	8	8
Negligence in operating	0	21	17	50
Unforeseen obstructions and maliciousness	0	5	4	6
Unexplained	1	2	3	16
Total	1	30	36	86

Thirty-one accidents caused the death of one or more persons each, and 29 caused injury, but not death, leaving 171 (74 per cent. of the whole) which caused no personal injury deemed worthy of record.

The comparison with May of the previous five years shows:

	1900.	1899.	1898.	1897.	1896.	1895.
Collisions	88	65	68	33	34	47
Derailments	134	108	76	46	73	58
Other accidents	9	8	6	8	2	6
Total accidents	231	181	150	87	109	111
Employees killed	36	22	28	11	17	16
Others killed	10	42	8	5	15	9
Employees injured	86	60	78	17	39	62
Others injured	46	148	60	48	37	65
Average per day:						
Accidents	7.45	5.84	4.84	2.80	3.52	3.58
Killed	1.48	2.06	1.16	0.84	1.03	0.81
Injured	4.26	6.07	0.45	2.10	2.45	4.10
Average per accident:						
Killed	0.20	0.35	0.24	0.18	0.29	0.22
Injured	1.75	1.15	0.92	0.74	0.70	1.14

The most unusual train accident in the record for May is the rear collision which occurred at Philadelphia on May 11. This collision was reported in the *Railroad Gazette* of May 25.

There is no report of any fatal injury to passengers in passenger trains in May. The most notable passenger train accident was, perhaps, the derailment at Jenkintown, Pa., on the 18th; and the verdict of the coroner's jury was as remarkable, in its way, as were the circumstances of the accident. At the highway crossing where this train was derailed there was a considerable flood of water running over the track, together with some gravel which was washed down from a hill near the line, the flood being due to a heavy shower. In consequence of the presence of the water and gravel the jurymen seem to have been unable to decide just what caused the derailment; and, being determined, evidently, to make no mistake, they finally agreed to report that "if the train had been stopped before the crossing was reached the accident might have been averted." Or, in the words of a local paper, if the fireman had not been killed on Friday he would have been alive on Saturday!

The accident record for May, 1899, included the rear collision at Exeter, Pa., where 29 persons were killed.

Near Baltimore, Md., on May 2, a party of five persons in a wagon was struck by an express train of the Northern Central and four persons were killed.

The newspapers report 17 electric car accidents in May, in which five persons were killed and 45 were injured.

At the close of the year 1898 the railroads in the German Railroad Union had an extent of 54,742 miles, of which 29,500 miles were in Germany, 20,915 in Austria-Hungary, and 4,327 in other countries (Holland,

Roumania, etc.). There were 56 miles of four-track, 28 miles of three-track and 13,431 miles of double-track road, leaving 40,140 miles of single-track, which is 73 per cent. of the whole. This year, for the first time, there are statistics of the weight of rails, showing 16 per cent. of the whole to weigh 60 lbs. per yard or less, 57¼ per cent. between 60 and 70 lbs., 24¼ between 70 and 80, and 2½ per cent. more than 80 lbs. per yard. There were still 5,467 miles of iron rails in main tracks, which was 8 per cent. of the whole. During the year 57 miles of track was renewed with iron rails and 2,875 miles with steel, and 3⅓ per cent. of all the track was renewed, implying an average life of 30 years for the rails if the whole wear was made good. In 1897 no less than 15,774 miles of track rested on iron sleepers. For 1898 figures are given only for main tracks, 10,254 miles of which were on iron cross-ties, and 2,095 miles on longitudinal iron sleepers, while 54,740 miles were on wooden cross-ties. The number of wooden ties renewed in 1898 was 9,911,099, of which no less than 69 per cent. had been treated by some preserving process. Of the wooden ties 4,350,000 were oak, and only 35 per cent. of these were treated, 4,676,000 were of pine, fir or other coniferous wood, and 95 per cent. of these were treated; and no less than 99¾ per cent. of the ties of deciduous woods other than oak were treated. These (beech, etc.), however, were comparatively few in number, not 9 per cent. of the whole number of wooden ties used. Besides these wooden ties, 1,443,339 iron (Bessemer steel is counted as iron) cross sleepers were used, and 615 longitudinal iron sleepers. The report of the Union says that wooden ties were replaced by iron only to an insignificant extent, and that a change in this regard is not to be looked for unless experience for a long series of years should show favorable results. As there are more than 15,000 miles of track on iron ties in Germany, no inconsiderable part of which has been laid for something like 20 years, this statement deserves attention. Of the steel rails laid during the year, only 6 per cent. weighed 60 lbs. per yard or less, 60 per cent. between 60 and 70 lbs., 36 per cent. between 70 and 80, 14 per cent. between 80 and 90, and 2 per cent. more than 90 lbs. per yard. Compared with proportions in main tracks given above, this shows the tendency to increase the weight of rails. The total cost of maintenance of road was about 62,500,000, or $714 per mile of track, $1,175 per mile of road, and almost exactly 10 cents per locomotive mile. Of these maintenance of road expenses, 16.3 per cent. went for ties, 12.2 for rails, 6.4 for joints, splices, spikes, etc., 3.3 for switches and parts appertaining thereto, and 61.8 for wages and for other materials. Ties, therefore, cost nearly one-third more than rails.

The administration of the State Railroads in Russia seems not to be in a settled condition. The government has a Ministry of Transportation, which would seem the natural organ for such business; but the Trans-Caspian Railroad, an important line, was until very recently worked by the War Department, which built it. Now this year the government has taken over a line from Moscow north to Archangel, most of it new; but this is to be worked by the Finance Department, and not by the Transportation Ministry.

Each year brings new evidence of a growing appreciation on the part of college authorities of problems having practical significance, and theses presented by students are now not infrequently based on researches of considerable magnitude. A fair illustration of this statement is to be found in a thesis dealing with the important subject of fire losses occasioned by passing locomotives, an abstract of which is given in another column.

Society for the Promotion of Engineering Education.

The Society for the Promotion of Engineering Education held its annual meeting at Columbia University, New York City, July 2, 3 and 4. The President's address was read at the first session on Monday, President Baker himself being absent in Europe. This is a review of engineering education in the United States at the end of the century and is a capital document. He finds that there are in the United States 89 institutions giving instruction in different branches of engineering, which he divides into five classes, according to the severity of their requirements and the thoroughness of their work. Of Class A there are 30 institutions. Of all of these, 67 offer courses in civil engineering, 61 mechanical engineering, 49 electrical engineering, 21 mining engineering, 15 architecture, two naval architecture, two sanitary engineering. In all of these institutions there are enrolled 9,679 students, and those taking the mechanical engineering courses are the most numerous, namely, 3,293. The civil engineers follow next, 2,667, and then the electrical engineers, 2,397. It is somewhat surprising to see that only 389 students are taking courses in architecture. More than one-half of the engineering students, namely, 5,027, are in the Class A institutions, namely, those having the highest requirements, which of itself strikes us as an interesting and important fact. The engineering graduates in 1899 numbered 1,413, and these were distributed among the different courses in about the same proportion as the students enrolled. One table gives data of schools for the four great professions, theology, law, medicine and engineering, and we see that theology has the greatest number of schools, but the smallest number of students, while medicine has much the greatest number of students, namely, 26,088. But the growth in the number of students enrolled since 1878 has been much greater in engineering than in either of the other professions, namely 516 per cent. Next comes law, 294 per cent.; then medicine, 142 per cent., and theology, 87 per cent. Ninety-eight per cent. of the engineering schools have four-year courses, 91 per cent. of the medical schools and 24 per cent. of the theological schools. So far as known none of the law schools have four-year courses.

Probably the most interesting and important report presented was that by a committee of which Prof. J. B. Johnson is Chairman, on "The Present Status and Tendencies of Engineering Education in America." This is an elaborate study of what is offered to-day in the way of engineering education, and of what should be offered, for the good of the people and the prosperity of the nation, in engineering or closely allied studies. The report in general is an argument for great expansion and liberalizing of the theories and means of education so as to give the youth of our country opportunities for instruction in the mechanical trades, in industrial matters and in commercial methods. The problem is stated broadly and carefully, but specific recommendations are not made.

A paper closely allied to this is on "The Relations of the Technical School and the Manufacturer," by Mr. Walter B. Snow, who points out that the school may serve the manufacturer by supplying men equipped for his work, by giving publicity to investigations, by furnishing information, etc. The manufacturer may be of assistance in determining the most suitable courses of practical study. He may suggest practical subjects for investigation, provide apparatus, materials and facilities, show the latest stage of the art by lectures, drawings, etc., and may open his works for visits of inspection. The other reports were generally of a rather closely technical character; that is, of special interest to educators rather than to the engineering public.

NEW PUBLICATIONS.

American Railway Engineering and Maintenance of Way Association.—The proceedings of the first annual convention of this Association appear in a pamphlet of 244 octavo pages. This convention was held, it will be remembered, at Chicago last March. The pamphlet now published not only contains the proceedings in full of the convention, but the constitution, list of charter members, list of officers and committees, outline of committee work, circulars issued to date, etc. The members of the Association now represent 155,236 miles of railroad and they number 279, which number has doubtless increased since this pamphlet was compiled. The secretary is Mr. L. C. Fritch, 1562 Monadnock Block, Chicago, Ill.

The Mechanical Equipment of the New South Station, Boston, Mass.—At the December meeting of the American Society of Mechanical Engineers, Mr. Walter C. Kerr presented a paper on the "Mechanical Equipment of the New South Station at Boston." In the preparation of this paper he was assisted by five of his subordinates and the result was an excellent description of a work unique in many ways. This paper, together with the discussion at the meeting, is now reprinted in a pamphlet and can be had from the Publication Department of the Westinghouse Companies at Pittsburgh. The reader will remember that Westinghouse, Church, Kerr & Co. were put in the unusual position of at once designing engineers and contractors for the mechanical features of this work. The work is described at length in the pamphlet, with many illustrations, but it is unnecessary for us to go into any particulars, for we have already published many articles about this station, covering its mechanical engineering, civil engineering and traffic features.

TRADE CATALOGUES.

Low Pressure Pneumatic Interlocking.—The International Pneumatic Railway Signal Co., of Rochester, N. Y., controlling the European patents of the Pneumatic Railway Signal Co., of the same city, which devices are made and sold in North and South America by the Standard Railroad Signal Co., of Troy, N. Y., has issued an illustrated pamphlet in English, German and French for distribution in connection with its extensive exhibit at the World's Fair in Paris. The pamphlet is illustrated with cuts, showing the low pressure pneumatic devices and views of some plants in operation on a number of railroads. It contains descriptions of the system, with some discussion of the relative merits of high-pressure electro-pneumatic and low-pressure pneumatic interlocking apparatus.

Standard Steel Rails and Splice Bars.—The Carnegie Steel Co., Pittsburgh, Pa., sends a catalogue of sections of rails which also shows splice bars, bolts and spikes, and contains the standard specifications of the Carnegie Steel Company for rails, splice bars, track bolts and nuts and spikes. The first rail section shown is No. 110A, which weighs 110 lbs. per yard and stands 6⅛ in. high. We do not discover that this has actually been rolled, but the 100-lb. rail, being section No. 100 A, has been rolled for a number of different companies. The weights and dimensions of these sections are tabulated in French as well as in English, although the specifications and other information are printed in English only.

Pneumatic Interlocking.—The low-pressure switch and signal apparatus made by the Standard Railroad Signal Co., and recently shown in the *Railroad Gazette*, is described and illustrated in a pamphlet just issued by the International Pneumatic Railway Signal Co., of Rochester, N. Y., the company which controls the machine outside of America. The pamphlet is illustrated from photographs of the machines at Jamaica, on the Long Island Railroad, and at Grove street, Jersey City, on the Erie. There are also pictures of details of the apparatus, of yards, signal bridges, etc. The pamphlet is not only interesting technically, but very attractive as an example of the printer's art. We judge that it is prepared especially for the World's Fair at Paris, as the names of agents in charge of the company's exhibit at Paris are given on the fly leaf.

Locomotive Coaling Stations.—The Link Belt Machinery Co., Thirty-eighth street and Stewart avenue, Chicago, issue their catalogue, No. 26, which is devoted especially to showing locomotive coaling stations and apparatus for handling ashes. A list of link belt coaling stations in operation upon railroads shows that the Northern Pacific has 26 of these and the New York Central seven. A number of other railroads have three or less each. We notice that the Erie is credited with one at Hoboken, various views of which are shown. This should be Jersey City instead of Hoboken. Photographs of many of these stations are given, some of them showing interior arrangements. A few pages of this same catalogue show freight carriers of various sorts as installed on docks in warehouses and at railroad stations.

Locomotives.—The Baldwin Locomotive Works issues its "Record of Recent Construction, No. 19." This issue is given especially to heavy engines. A striking picture appears of the erecting yard for locomotives for the Chinese Eastern near Vladivostock. The conditions seem somewhat discouraging, as there are no buildings and the ground is covered with snow and ice. The engines shown are a consolidation for the Pennsylvania, a 10-wheeler for the Chesapeake & Ohio, a compound consolidation for the Bavarian State Railroads and other heavy engines for the United States and various countries.

The Canadian Iron Trade in 1899.*

The progress of the Canadian iron and steel industries in 1899, as in the two preceding years, has been greatly promoted by the action of the Dominion Parliament in enacting the bounty act of June 29, 1897, which provided for the payment of liberal bounties by the Dominion Government to the makers of steel ingots, puddled iron bars and pig iron. An act of the Dominion Parliament dated August 11, 1899, extended the bounty provisions about five years, to June 30, 1907, provided, however, that they be annually reduced a certain per cent. after April 23, 1902.

The production of pig iron in the Dominion of Canada was first ascertained by the American Iron and Steel Association for the year 1894, when it amounted to 44,791 gross tons. In 1895 the production amounted to 37,829 tons, in 1896 to 60,030 tons, in 1897 to 53,796 tons, and in 1898 to 68,755 tons. In 1899 the production of all kinds of pig iron, including spiegeleisen and ferro-manganese, was 94,077 tons, of which 17,796 tons were charcoal and 76,281 tons were charcoal and coke mixed and coke pig iron. The production of Bessemer pig iron in 1899, included in the figures given above, was 5,120 tons, and the production of basic pig iron was 22,666 tons —all made by one company. The total production of pig iron in 1899, as compared with that of 1898, shows an increase of 25,322 tons. The consumption of limestone by the Canadian furnaces in 1899 amounted to 50,726 tons, against 30,302 tons in 1898.

On December 31, 1899, there were nine completed blast furnaces in the Dominion, and of this number four were in blast and five were out of blast. On December 31, 1898, there were also nine completed furnaces, of which three were in blast and six were out of blast.

The production of Bessemer and of basic and acid open-hearth steel ingots and castings in 1899 was 22,000 gross tons, against 21,540 tons in 1898. The production of iron rails and open-hearth steel rails in 1899 amounted to 835 gross tons, against 600 tons in 1898; structural shapes, 2,899 tons, against 1,565 tons in 1898; cut nails made by rolling mills and steel works having cut-nail factories connected with their plants, 235,981 kegs of 100 pounds, against 152,688 kegs in 1898; plates and sheets, 2,220 tons, against about 1,000 tons in 1898; all other rolled products, excluding muck and scrap bars, blooms, billets, sheet bars, etc., 94,153 tons, against 80,322 tons in 1898. Changing the cut-nail production from kegs to gross tons, the total quantity of all kinds of iron and steel rolled into finished products in the Dominion in 1899, including muck and scrap bars, billets and other intermediate products, amounted to 110,642 tons, against 90,303 tons in 1898, 77,021 tons in 1897, 75,043 tons in 1896, and 66,402 tons in 1895.

The total number of completed rolling mills and steel works in Canada on December 31, 1899, was 16. Of this number at least three were idle during the whole of 1899.

*Extracts from the Annual Statistical Report of the American Iron and Steel Association for 1899.

Train Accidents in the United States in May.

COLLISIONS.

Rear.

6th, 2 a. m., on Baltimore & Ohio, at Cumberland, Md., a freight train ran into the rear of a preceding freight, wrecking the caboose and one car, which took fire and were burned up. The engineman was injured.

7th, on Buffalo, Rochester & Pittsburgh, at West Valley, N. Y., a freight train ran into the rear of a preceding freight and the engine and 15 cars were badly damaged. Two trainmen were injured.

11th, 11 p. m., on Baltimore & Ohio, near Park Junction, Philadelphia, Pa., a freight train which had become stalled on an ascending grade in a tunnel was run into at the rear by a following Philadelphia & Reading freight train and the engine and many cars were wrecked. The engineman and fireman were killed. Four of the cars were tanks of oil or naphtha, and the explosion of these and the accompanying fire did great damage to the tunnel. The fire raged for about 20 hours. The block signalman near the entrance of the tunnel admitted the second train without assuring himself that the first one had cleared the block section. This collision was reported in the *Railroad Gazette* of May 25.

15th, on Baltimore & Ohio, at Snowden, Pa., a freight train broke in two on a descending grade and the rear portion afterward ran into the forward one. Several cars fell off a trestle and landed in a ravine 40 ft. below. There were 15 tramps on the train, of whom three were injured.

21st, on Northern Pacific, near Trent, Wash., a freight train ran into the rear of a preceding freight, badly damaging two engines and nine cars. Three cars of oil exploded and the wreck was destroyed by fire.

22d, on Great Northern, near Everett, Wash., a work train broke in two and the rear portion afterward ran into the forward one, wrecking several platform cars. Seven employees were injured, one of them fatally.

27th, on Philadelphia & Reading, in Mahanoy Tunnel, a freight train ran into the rear of a preceding freight, near the center of the tunnel, and the caboose was derailed and set on fire. The collision was due to the failure of the block signal operator at the entrance to the tunnel to hold the second train until the first one had cleared the block.

And 31 others on 21 roads, involving two passenger and 44 freight and other trains.

Butting.

5th, on Pennsylvania road, at Aspinwall, Pa., butting collision of freight trains, wrecking eight cars. One brakeman was injured. It is said that the eastbound train was on the westbound track without proper authority.

9th, on Plant System, at Hardeeville, S. C., a southbound passenger train collided with a northbound passenger train of the Southern Railway, badly damaging the engine and several cars. The fireman of the northbound train was killed and five other trainmen were injured. It is said that the southbound train was running on the time of the northbound.

12th, 1 a. m., on Delaware, Lackawanna & Western, near Clark's Summit, Pa., butting collision between two freight trains, each of which was drawn by two engines. Three engines and several cars were damaged and one fireman was killed. The collision was due to a mistaken lantern signal. The engineman of the eastbound train acted on a go-head signal which was intended for another train, but which was not properly made.

17th, 1 a. m., on New York Central & Hudson River, at Tiadaghton, Pa., butting collision of freight trains, damaging both engines and wrecking several cars. Four loaded cars took fire from the coals of one of the engines and were burned up. One engineman was injured. One of the trains had stopped to do some work and had sent a flag to warn the other, but the signal was not obeyed.

18th, on Nashville & Knoxville, near Gordonsville, Tenn., butting collision between a passenger train and a work train, badly damaging both engines. Three trainmen and one passenger were injured.

19th, 5 a. m., on Cleveland, Cincinnati, Chicago & St. Louis, at Thorntown, Ind., butting collision of freight trains, badly damaging both engines. Several cars fell down a bank. It is said that one of the trains failed to observe green signals on a train running in the opposite direction. One brakeman was injured.

And two others on two roads, involving four freight trains.

Crossing and Miscellaneous.

2d, on Southern Railway, near Charlotte, N. C., collision between a passenger train and a switching engine; one fireman killed.

2d, on New York, New Haven & Hartford, at Worcester, Mass., a passenger train ran over a misplaced switch and into some freight cars standing on a sidetrack. Four freight cars were wrecked. The fireman jumped off and was injured.

2d, 10 p. m., on Boston & Albany, near Springfield, Mass., collision of freight trains; two trainmen injured.

8th, on Atlantic Coast Line, near Fremont, N. C., collision between a passenger train and a freight; one trainman injured.

8th, 9 p. m., on Fitchburg road, at Mechanicsville, N. Y., a freight train ran into a freight car which had accidentally run out of a siding on the main track, and one caboose and three loaded freight cars were wrecked. A brakeman was injured. The wreck took fire and was mostly burned up.

9th, on Buffalo, Rochester & Pittsburgh, near Newtons, Pa., passenger train No. 9 ran into the head of a work train, doing slight damage. Six passengers and two trainmen were injured. A forest fire prevailed at the time and the people on the train narrowly escaped being overcome by smoke. The work train men had been fighting fire. Most of them had run away, and the few left were lying on the ground to escape suffocation. A woman passenger—Mrs. Parks—ran back to the nearest station and gave the alarm before the flagman reached there.

15th, 3 a. m., on Hocking Valley road, at South Columbus, O., collision between a freight train and a yard engine, doing slight damage; one trainman injured.

17th, on Philadelphia & Reading, near Shamokin, Pa., collision between some freight cars and an empty engine, wrecking eight cars. A man stealing a ride on the freight cars was killed.

17th, on Pennsylvania road, near Mt. Holly, N. J., several cars broke away from a gravel train, and, running down-grade some distance, collided with a passenger train. Two passengers and two trainmen were injured.

18th, on New York Central & Hudson River, near Lock Haven, Pa., collision between a freight and a work train, wrecking two cars and blocking the road some time. A freight train which had been detained by this wreck was run into at the rear by another freight, and two brakemen sleeping in the caboose were killed.

22d, on Baltimore & Ohio, near Cumberland, Md., collision of locomotives; conductor and fireman injured, the latter fatally.

24th, on Philadelphia & Reading, near Shelly, Pa., collision of freight trains; one brakeman injured.

29th, on Southern Pacific, at San Antonio, Tex., collision of freight trains; two tramps killed.

And 28 others on 22 roads, involving six passenger and 44 freight and other trains.

DERAILMENTS.

Defects of Roadway.

6th, on Missouri, Kansas & Texas, near St. Charles, Mo., a passenger train broke through a trestle bridge, which had been weakened by a flood, and the engine and several cars were wrecked. The engineman and fireman were killed.

8th, on Cleveland, Lorain & Wheeling, near Canal Dover, O., a freight train broke through a trestle bridge and 12 cars were wrecked. A man stealing a ride was killed and two others were injured.

15th, on Seattle & International, near Preston, Wash., a freight train loaded with logs broke through a trestle bridge and the whole train, consisting of an engine, tender, eight cars and a caboose, fell about 110 ft., to the valley below. Four trainmen were injured.

21st, 2 a. m., on Texas & Pacific, near Ravenwood, La., passenger train No. 51 was derailed at a bridge which had been damaged by fire; engineman and fireman injured.

31st, on San Antonio & Aransas Pass, near Tanglewood, Tex., a passenger train was derailed at a bridge which had been weakened by a flood and the engineman and fireman were killed.

And five others on five roads, involving one passenger train and four freight trains.

Defects of Equipment.

8th, on New York Central & Hudson River, at Saugerties, N. Y., a freight train, with an engine at the rear, as well as in front, was stopped by the automatic application of the air brakes at the front part of the train, and a number of cars were wrecked. A man riding in the caboose was injured.

10th, 8 p. m., on Pennsylvania road, near Wilmore, Pa., an eastbound freight train was derailed by a broken axle and four cars were wrecked. A brakeman was injured.

10th, 8 p. m., on Pennsylvania road, near Wilmore, Pa., a westbound freight was suddenly stopped on account of the loosening of two driving wheel tires, and three cars were wrecked.

11th, on Choctaw, Oklahoma & Gulf, near Forrest City, Ark., passenger train No. 1 was derailed by a broken wheel; two passengers injured.

14th, on Chattanooga Southern, near Menlo, Ga., a fast freight train was derailed by the breaking of one of the trucks of the tender, and several cars were ditched. The engineman was killed.

18th, on Philadelphia & Reading, at Jenkintown, Pa., an eastbound express train was derailed by the dropping of the pilot while passing over a highway crossing. The engine, a very heavy one, ran into and broke down the wall of the baggage room, in which were a number of passengers, who had gathered there to escape a very heavy shower of rain. The engine was turned completely around and the engineman landed on the roof of the building without being fatally injured. The fireman was killed. Five persons at the station were slightly injured. The first three cars of the train were derailed and fouled the westbound track, but their occupants were not seriously injured.

22d, on Western New York & Pennsylvania, at Carrollton, N. Y., a freight train was derailed by a fallen brake beam and the engine and five cars were ditched. Two trainmen were injured.

23d, on Charleston & Western Carolina, near Laurens, S. C., a freight train was derailed by a broken truck and the engine and six cars were wrecked. The engineman and fireman were killed, being badly burned by coals from the firebox.

23d, on Central of New Jersey, near North Branch, N. J., a freight train was derailed by a broken wheel and 21 cars were badly damaged. A tramp was killed and two trainmen were injured.

And 22 others on 17 roads, involving one passenger train and 21 freight and other trains.

Negligence in Operating.

8th, on Union Pacific, at O'Neill, Wyo., a freight train, drawn by two engines, was derailed at a misplaced switch and the engines and several cars fell down a high bank. Two firemen and two men stealing rides were killed and two enginemen were injured.

10th, on Arizona & New Mexico, near Clifton, N. M., a freight train was derailed at a bridge which was undergoing repairs, and 12 cars were ditched and wrecked. The engineman and fireman were killed and nine bridge carpenters were injured. It is said that the bridge foreman should have sent a signal to stop the train, but failed to do so.

10th, 11 p. m., on Philadelphia & Reading, near Shamokin, Pa., a freight train from which the engine had been temporarily detached, being left unattended, ran down a steep grade and was derailed and partially wrecked, together with some cars on another track, which were struck by the derailed cars. A man stealing a ride was killed. It is said that the brakes on the standing train had been maliciously loosened.

11th, 1 a. m., on Texas & Pacific, near Geary, La., a passenger train was derailed by a misplaced switch and the engine and first three cars were ditched. Two trainmen and two passengers were injured.

13th, on Colorado Midland, at Aspen, Col., a passenger train was derailed at a misplaced switch and two passengers were injured.

22d, on Southern Pacific, near Oakland, Cal., a passenger train was derailed by a misplaced switch and the engine was overturned. The engineman and fireman were killed and five passengers were injured.

23d, on Lake Shore & Michigan Southern, at Westfield, N. Y., westbound fast mail train No. 35 was derailed at a misplaced switch and the engine and six mail cars were badly damaged. The engineman and fireman were killed and several mail clerks were injured.

And 13 others on 13 roads, involving three passenger and 10 freight and other trains.

Unforeseen Obstructions.

1st, 10 p. m., on Great Northern, near Great Falls, Mont., a passenger train was derailed by a switch which had been maliciously misplaced, and two passenger cars were badly damaged. A number of freight trainmen were on strike at the time of this derailment and it is said that they or their friends purposely derailed the train.

4th, on Detroit & Mackinac, near Onaway, Mich., a passenger train was derailed by an accidental obstruction, and five cars were ditched. One man was injured.

4th, on Baltimore & Ohio, near Gastonville, Pa., passenger train No. 107 was derailed at a curve, apparently by a malicious obstruction, and the engine and first two cars were ditched. One employee was killed and two others were injured, one of them fatally.

5th, on Visalia & Tulare, near Visalia, Cal., a passenger train was derailed by running over a calf, and the engine and one passenger car were overturned. Five passengers and one trainman were injured.

7th, on Yazoo & Mississippi Valley, near Frellsen, La., a passenger train was derailed by running over a horse, and the engine and baggage car were ditched. Three tramps stealing a ride were injured.

15th, on Norfolk & Western, near Honaker, Va., a freight train was derailed by running over a cow and one of the two engines was ditched. One engineman was injured.

22d, on Great Northern, near Leavenworth, Wash., a freight train was derailed by a landslide and the engine and eight cars fell into a river. The engineman was killed.

29th, on Kewaunee, Green Bay & Western, near Kewaunee, Wis., a freight train was derailed at a washout, ditching several cars. The fireman was killed and the engineman injured.

30th, on International & Great Northern, near Tyler, Tex., a freight train was derailed by a washout and 13 cars were ditched and partially submerged. A brakeman was injured.

And six others on five roads, involving six freight trains.

Unexplained.

1st, on Southern Pacific, near Oakland, Cal., a locomotive running backward was derailed and overturned. The engineman and fireman were injured.

3d, on Southern Pacific, near Muldoon, Tex., a freight train was derailed and the caboose and three cars were wrecked. The conductor was injured.

5th, on Kansas City Southern, near Mooringsport, La., a freight train was derailed and a brakeman killed.

7th, on Sherman, Shreveport & Southern, at Princeton, Tex., a freight train was derailed and three cars were ditched. A brakeman was injured.

7th, on Atchison, Topeka & Santa Fé, near Ardmore, I. T., a freight train was derailed and several cars of cattle and merchandise were wrecked. A boy stealing a ride was killed and two others were injured.

11th, on Galveston, Houston & Northern, near Laporte, Tex., a passenger train was derailed and the express messenger was injured.

14th, on Southern Pacific, near Oakland, Cal., a passenger train was derailed and the engine was overturned in the ditch. The engineman and fireman were injured, the latter probably fatally.

16th, 2 a. m., on Missouri, Kansas & Texas, near Kincaid, Kan., a freight train running at good speed was derailed on or near a trestle and the caboose and several cars broke through the floor. A drover was killed and two others were injured.

16th, on Seaboard Air Line, near Raleigh, N. C., a freight train was derailed and one trainman was injured.

16th, on Lehigh Valley, near Waterloo, N. Y., an engine running backward and drawing one passenger car was derailed, the tender being the first to leave the track, and the whole train was ditched. The engineman, fireman and one brakeman were injured.

17th, on Southern Pacific, at Sheridan, Cal., the locomotive of a work train was derailed and overturned and the engineman was injured.

19th, on Pittsburgh & Western, at Newcastle Junction, Pa., a freight train was derailed; conductor killed and two brakemen injured.

26th, on New York, New Haven & Hartford, at Fall River, Mass., a freight train was derailed and the engineman was injured.

28th, on Pittsburgh, Cincinnati, Chicago & St. Louis, near Pittsburgh, Pa., two cars in a freight train were derailed and fell off the roadbed to the street below, narrowly missing a heavily loaded street car. Two brakemen were injured.

And 44 others on 29 roads, involving one passenger train and 43 freight and other trains.

OTHER ACCIDENTS.

3d, on Ogdensburg & Lake Champlain, near Bangor, N. Y., a plug blew out of the boiler of a locomotive and the engineman and fireman were badly scalded.

17th, on Illinois Central, near Dubois, Ill., the locomotive of a southbound passenger train was wrecked by the explosion of its boiler and the engineman and fireman were killed. The first two cars were badly damaged.

25th, on Boston & Maine, near Reading, Mass., a car in a passenger train was badly damaged by a timber which projected from a freight train passing on the adjoining main track. Several passengers were injured.

29th, on Baltimore & Sparrow's Point, near Sollers, Md., the engine of a freight train was wrecked by the explosion of its boiler. The engineman was killed and the fireman fatally injured.

And five others on four roads, involving three passenger and two freight trains.

A summary will be found in another column.

Railroads in West Africa.

Mr. F. Shelford, B.Sc., M.I.C.E., consulting engineer on African railroads to the British Colonial Office, recently lectured at Liverpool on "West African Railways."

At Sierra Leone the railroad was almost completed to Rotofunk—56 miles from Freetown. This work was a fine example of modern narrow-gage, the gage being 2 ft. 6 in. The progress had been greatly retarded by the hut tax revolt in 1898, but the trade of the colony had shown an extraordinary recovery after the disturbance was quelled. A portion of the line to Songe Town had been opened last May, and was doing well.

On the Gold Coast line good progress has been made with the Sekondi-Tarkwa line of 3 ft. 6 in. gage so far in face of great difficulties in landing goods in surf boats, the enor-

mously heavy clearing required, and the difficulty of obtaining labor. Labor was very scarce at this part of the Gold Coast, and the cost of importing labor was prohibitive unless a long extension of the line was authorized. The rails were expected to reach Tarkwa in the early autumn.

At Lagos the Carter Bridge—half a mile long—had been completed in eighteen months over the Lagoon, which was of great depth, and had a soft mud bottom and a current of four or five knots. The Denton road and railway bridges were also complete. The railway, which was 3 ft. 6 in. gage, was opened as far as Abookuta (which had a population of 150,000) on August 1 last, and was already doing well The progress was greatly impeded by the difficulties with the French in 1897, when the laborers were absorbed as carriers to the armed forces sent up. The extension to Ibadan (130 miles, population 180,000) had proceeded very rapidly, the last 41 miles of heavy earthworks being carried out in seven months. The earthworks were completed to Ibadan, and the rails were expected to arrive there in a few weeks.

The railroads already constructed made little impression on the vast areas of the colonies. At Sierra Leone the amount of country tapped was insignificant, and an extension of 80 miles of light line would open up an area of 5,000 square miles to the influence of the railroad. On the Gold Coast an extension of the Sekondi-Tarkwa railroad to Kumasi was proved feasible by Mr. Shelford himself when he traveled through the almost unexplored country in the spring of last year. Along the whole length of this route numerous gold concessions had been granted, many of them of great promise, and it was possible that the construction of this line might cause a great development of African gold mines. A line from Accra, the capital of the Gold Coast, to Pong, upon the Volta River, was surveyed and reported upon at the same time. It would be easy and cheap to make, and would serve a large and industrious population, and tap the rich country where palm kernels and other natural produce and oil were now allowed to lie upon the ground because the cost of transport prevented their reaching the market. In the country beyond Ibadan toward the Niger there were numerous large towns, such as Oyo (population, 60,000), Ogbomosho (30,000), Ilorin (70,000). It was a question whether the Lagos Railway, with a bad harbor at its base, should be extended to the Niger, and on to Hausaland, Sokoto and Kano, or whether this country should be reached from the Niger Coast Protectorate.

The railroads in West Africa were costing about £6,000 a mile, including the starting of operations and the erecting of workshops, quarters, offices and landing-stages, and had proceeded at rates of approximately 14 miles a year at Sierra Leone, 20 miles a year on the Gold Coast, and 26 miles a year at Lagos. If extensions were authorized they could be carried out at a considerably reduced cost per mile, and if considerable were authorized at the same time the speed could be very greatly increased. The approximate cost of £6,000 per mile compared favorably with the Congo Railway, which cost over £10,000 a mile, although of only 2 ft. 6 in. gage, with very steep gradients and a fairly open country.

A Pneumatic Yoke Riveter.

The accompanying engraving shows a yoke riveter which has recently been brought out by the Standard Pneumatic Tool Company. This is made with two sizes of hammers, one capable of driving rivets up to 1¼ in. in diameter, and the other as large as ⅞-in. rivets. The yoke is made of any required length and the distance between dies when fully open is 6 in. It will be seen, however, that the hammer is adjustable in the yoke so that the opening can be varied to suit the work. Either a pneumatic or solid hold-on is used, and one of the novel features of the hammer is a clamp which is moved out by air and presses the plates up against the rivet set. This clamp is in the form of a sleeve surrounding the barrel of the hammer and when the riveter is not working it is withdrawn by the action of a light spiral spring.

Standard Pneumatic Riveter.

Steamship Disaster in New York Harbor.

A fire on the pier of the North German Lloyd Steamship Company, at Hoboken, N. J., on Saturday afternoon, June 30, destroyed three ocean steamships and other property to the value of several million dollars and resulted in the loss of a great many lives; at this writing variously estimated at from 200 to 400. The fire was first discovered in a bale of cotton on the pier about 4 p. m. A strong southwest wind was blowing. Little can be gathered as to the reason for the very rapid spread of the flames, but in a few minutes three piers and three large steamships were ablaze from one end to the other, and all efforts at subduing the fire were practically ineffectual. It is said that after a few minutes the wind changed and blew from the northwest, and that this is one thing that made the spread of the fire so rapid. The persons killed were mostly members of crews and laborers on the vessels. Many were in the holds, unable to escape, and were burned to death, and some who might have jumped into the water did not do so. Tugs and other vessels which came to the rescue saved many people who were in the water, and 100 or 200 injured persons were cared for at the hospitals of New York, Hoboken and Jersey City. The ships that were destroyed were the Saale, the Bremen and the Main, the latter a new vessel. The Kaiser Wilhelm der Grosse, the largest ship of the company and the fastest on the Atlantic, was slightly damaged by the fire. Many small vessels took fire and at one time the river seemed to be full of blazing barges and lighters. One pier of the Thingvalla Line, north of the North German Lloyd, was badly damaged, and also a vessel of the Hamburg-American Line, on the south. Campbell's stores, five large buildings, containing valuable merchandise, were entirely destroyed. The entire loss is roughly estimated at $5,000,000. Captain Mirow, of the Saale, is among those who were burned to death.

TECHNICAL.

Manufacturing and Business.

The Bethlehem Steel Company has now in hand the entire equipment of steel shafts and engine forgings which are to go into the new steamer building by Harlan & Hollingsworth Co., at Wilmington, for the Mallory Line. These forgings are to be made of open-hearth steel, forged under hydraulic pressure and annealed. The Company is also making the shafts and forgings for the 11,000-ton steamer to be built by Union Iron Works of San Francisco for the American-Hawaiian S. S. Co. In this instance the owners specify that all the parts mentioned should be made at Bethlehem.

James A. Ellis, of Detroit, Mich., maker of the Welch automatic lock lifter, and formerly with the Michigan Malleable Iron Co., and the Thornburgh Draft Rigging Attachment Co., died at Detroit, June 29, after a short illness.

The Chicago Grain Door Co. has received within the past 60 days orders for grain door equipment as follows: Minneapolis, St. Paul & Sault Ste. Marie, 3,000 cars; Northern Pacific, 1,000 cars; Great Northern, 1,000 cars; Chicago, Milwaukee & St. Paul, 1,000 cars; Atchison, Topeka & Santa Fe, 500 cars; Illinois Central, 2,500 cars; Intercolonial of Canada, 1,100 cars; Canadian Pacific, 1,200 cars.

The Hall Signal Co., 44 Broad street, New York city, has the contract for the new automatic electric block signals on the Philadelphia & Reading, between Fort Washington and Lansdale.

The Sargent Automatic Railway Signal Co., of Rochester, N. Y., has been reorganized, and Mr. Sargent is no longer connected with the company. At a meeting last week the following gentlemen were chosen directors: Edmund Ocumpaugh, Jr., F. W. Zoller, Percy R. McPhail, John N. Beckley, George W. Archer, Abraham J. Katz and Philip Kescialowski. The Directors have elected Edmund Ocumpaugh, Jr., President; F. W. Zeller, Vice-President; Percy R. McPhail, Secretary and Treasurer and John A. Barhite, Counsel. The capital of the new company is $1,000,000, and in the new title the word "Railway" is omitted. This company makes a semaphore signal which is worked by an electric motor.

Iron and Steel.

The Belgian State Railroad is in the market for 75,000 fish plates, 300,000 fish bolts, 1,600,000 railroad screws and 300,000 spring washers and other track material and supplies. Specification blanks can be had from the head office of the railroad in Brussels. The delivery of the material to begin about January, 1901.

J. A. Short, Superintendent of the North Birmingham furnaces of the Sloss-Sheffield Steel & Iron Co., at Birmingham, Ala., has been appointed Superintendent of the furnaces in the Sheffield district, the appointment being effective at once. James McLaughlin will succeed Mr. Short at the North Birmingham furnaces.

The Carlin Locomotive Works has been organized in Pittsburgh, with a capital of $150,000, which will be increased as soon as the plant is begun, by W. J. Carlin, Loren H. Turner, Wm. C. Scott, Thomas McBride and James S. Braden. The company proposes to build light locomotives and has already under way a steel building 175 x 200 ft. on Twenty-fifth street. Mr. Carlin, the President, is President and Treasurer of the Thomas Carlin's Sons Co., of Allegheny. Mr. Turner is Superintendent of Motive Power & Equipment of the Pittsburgh & Lake Erie.

Hollow Forged Shafts.

The City Engineer of Chicago recently placed with Bethlehem Steel Company an order for a hollow-forged shaft to replace a breakdown in the North Side pumping station. The new shaft, which measured 13 ft. 8½ in. in length, 19 in. in diameter, and weighed close to 10,000 lbs., was booked on May 30, and, under special emergency instructions, was hollow-forged, annealed and rough-machined in time to go forward June 9. Many of the power stations in Chicago and other Western cities are equipped with shafts of this description, but this is the first time a hollow forging has been specified for water-works engines in that section of the country.

Brake-Beam Patents.

The Sterlingworth Railway Supply Co. has served a notice on the Monarch Brake-Beam Co., at Detroit, that their two-piece fulcrum is a direct infringement on the Sterlingworth patent, and unless the manufacture and sale of this two-piece fulcrum is discontinued within ten days from date, they will bring suit for infringement.

Pneumatic Tool Litigation.

We have from the Philadelphia Pneumatic Tool Co. the following letter, dated June 27:

"Regarding a notice published in your reading columns last week of an infringement suit brought against us by the Chicago Pneumatic Tool Co. we would say that to the best of our knowledge and belief this suit has not been brought in good faith. In support of this belief we would say that in our answer to the bill of complaint filed by the Chicago people in the Circuit Court here, we were able to flatly deny every statement made in the bill of complaint, and further the complainants have failed to file a bond in the Circuit Court to cover costs. We have no idea that this suit will be pressed, but should it be pressed, we are prepared to not only set up a defense of non-infringement, but to invalidate most of the claims in the patent cited by the Chicago people. Our hammers involve many new and improved principles and are fully covered by our own United States and foreign patents. All our customers are guaranteed against any losses on account of suits that may be brought against us."

Wilder's Snow Plows.

W. E. Wilder, 355 Boylston street, Boston, Mass., formerly with the Russell Snow Plow Co., has brought out several designs of snow plows for single and double-track work. The Wilder double end plow, for single or double-track work, can be run with either end forward, and therefore saves the time and trouble of turning. The engine is coupled to one end of a long beam running through the center, which can be extended beyond either end of the plow, while the opposite end is retracted within the plow and the opening closed. This device is easily worked and quickly adjusted. The special feature of the double-track plow is the form of the moldboard. This is wedge-shaped, the point being to one side of the center, so that it enters a drift easily until the plow is thoroughly under the snow. Mr. Wilder has also patented an elevator plow and a flange.

Electric Service for Boston Suburban Lines.

The well-informed New Haven correspondent of the *Evening Post* (New York) says: "It is stated officially that plans have been made by the New Haven Railroad Co. for the installation of the suburban electric service in connection with the Union Station at Boston. A third-rail system of an entirely new character will be used. The correct figures for the new pattern of high-power motor trolley car, tested a few days ago on the New Canadian branch, show that it ran, without stop, 8½ miles in 11¼ minutes. The new car represents the type which will be used on the newly electrified Providence, Bristol, Warren and Fall River lines, which have twenty-two miles of track."

American Car & Foundry Company.

At the annual meeting of the American Car & Foundry Co., held in New York, last week, the following report was submitted for the fourteen months ended April 30, 1900:

Gross earnings	$6,831,599
Expenses	802,086
Net earnings	$6,029,513
New construction charged off	294,564
Total net earnings	$5,734,949

The number of directors has been increased from thirteen to twenty. The following were elected: William McMillan, W. K. Bixby, F. H. Deton, George Coppell, Louis Haggin, George H. Russell, W. J. McBride, E. F. Carry, J. L. Smyser, George Hargreaves, C. R. Woodin, L. J. Cox, W. M. McMillan, F. E. Canda, S. S. De Lano, Lenox Smith, W. G. Weller, W. F. Lowry, D. A. Bixby, F. H. Eaton and William M. Hager. The retiring directors are: E. N. Dickerson, H. B. Denker, Anthony Gref and J. B. Haggin.

A dividend of ½ of 1 per cent. on the common stock in addition to the regular dividend of 1¾ per cent. on the preferred stock was declared.

The following are the officers for next year: President, W. K. Bixby; Vice-President, Frederick H. Eaton; Second Vice-President, W. P. Coleman; Third Vice-President, E. F. Carry, this being a new office; Treasurer and Chairman of the Board, Wm. McMillan; Auditor, J. M. Buick; Comptroller, S. S. DeLano; General Manager, W. J. McBride; Secretary, F. F. Webber; First Assistant Treasurer, E. R. Hoadley; Second Assistant Treasurer and Assistant Secretary, Wm. M. Hager; Assistant Secretary for the West, W. T. Hazard.

U. S. Castiron Pipe & Foundry Officers.

The new Board of Directors of the U. S. Castiron Pipe & Foundry Co. has elected the following officers: Samuel Thomas, President; A. F. Callahan and A. H. McNeal, Vice-Presidents, and B. F. Houghton, Secretary and Treasurer. The Board is as follows: Samuel Thomas, Colgate Hoyt, A. C. Overholt, George B. Hayes, George J. Long, A. H. McNeal, E. C. Fuller, John R. Walsh, A. N. Brady, B. F. Overholt, A. F. Callahan, C. E. Burke and A. Howard Hinkle.

New Lackawanna Iron & Steel Directors.

At a meeting of the stockholders of the Lackawanna Iron & Steel Co., in Scranton, June 29, it was decided to increase the number of directors from 9 to 15, and to extend the charter rights to enable the company to carry on its business at Buffalo. The new directors will be chosen at a future meeting from among the capitalists who have joined with the Lackawanna Co. in building a new $50,000,000 plant at Buffalo.

Iron Companies Unite.

The American Rolling Mill Co., of Cincinnati, Ohio, has secured control of the American Steel Roofing Co., and has increased its capital from $350,000 to $500,000. Of this amount $400,000 is common stock and $100,000 preferred 7 per cent. cumulative. The actual paid in capital stock at present is $350,000. Both concerns will, after the completion of the rolling mill plant at Middletown, be operated under one management. George M. Verity will be President, W. T. Simpson Vice-President, and R. C. Phillips Secretary. In addition to these the directorate will be made up of Major Harlan P. Lloyd, Jacob Meurer, of Meurer Bros., Brooklyn, N. Y., and James B. Strawbridge, late of the Norton Tin Plate Works, of Chicago, Ill. Mr. Strawbridge will have charge of the mills.

Electric Traction on Canals.

Some experiments on canal boat traction by means of electric locomotives have lately been made by Messrs. Siemens & Halske for the Prussian Government. The canal chosen for the experiments has several reverse curves, and on one curve of 328 ft. radius the waterway is spanned by a railroad bridge. A towing track 3.28 ft. gage was laid. The outer rail weighed 18.2 lbs. per yard and the inner rail 9.1 lbs. per yard. These were flanged rails resting partly on sleepers, with gravel ballast, and partly on blocks of concrete. These blocks weighed 220 lbs. for the heavy rails and 110 for the light rails. This arrangement cost from $250 to $400 more per mile than the sleeper track, but was less expensive to maintain. A steel rack was bolted to the web of the heavy rail, the weight of the locomotive not giving enough adhesion. The current was carried on a wire and the potential was 500 volts. The principal rail carried the return current. The towing locomotive was mounted on four wheels and weighed two tons, 1-5 of this weight being carried on the light rail. This latter, however, had to take the vertical component of the tension on the tow rope. This motor was more powerful than necessary, as it was capable of working at from 14 to 15 horse-power. The experiment is said to have worked with safety and economy, although we find no particulars in *Engineering* (London) from which these facts are taken.

The Crucible Steel Consolidation.

The consolidation of the leading crucible and tool steel makers, under way for some months, and mentioned in this column last week, will be known as the Crucible Steel Company of America, with headquarters in Pittsburgh. It is expected that organization will be perfected within 30 days. The capital stock will be $50,000,000, equally divided between preferred and common. The constituent companies will take stock in payment for their plants, while inventories will be paid in cash. Of the preferred stock from $15,000,000 to $20,000,000 will be used in buying the plants, the balance to be sold to get working capital. The following 13 plants are expected to be taken over: LaBelle Steel Co., Singer, Nimick & Co., Inc.; Howe, Brown & Co., Ltd.; Crescent Steel Co., Aliquippa Steel Co., Anderson, DuPuy & Co., and Park Steel Co., all of Pittsburgh; Cumberland Steel & Tin Plate Co., Cumberland, Md.; the Benjamin Atha & Illingworth Co., Harrison, N. J.; Spaulding & Jennings Co., of the West Berger Steel Works, Jersey City, N. J.; Sanderson Bros. Steel Co., Syracuse, N. Y.; Burgess Steel & Iron Works, Portsmouth, O.; Beaver Falls Steel Works, Beaver Falls, Pa. The Union Trust Co., of Pittsburgh, is to be registrar.

Compressed Air Traction.

The Compressed Air Co. has received a contract from the City Railway Co., of Rome, N. Y., to equip about 15 cars with its new motor. A director of the company said that several applications for motors had been received. The company expects to do a large business this year, and from present indications the works in Rome, N. Y., will be taxed to their utmost capacity.

THE SCRAP HEAP.

Notes.

The Grand Trunk now runs one train each way daily between Montreal and Chicago, via Detroit, 877 miles, in 23 hours and 30 minutes, or at the rate of 37.3 miles an hour.

An express train of the Burlington road was stopped by robbers on the morning of June 28, near Bradshaw, Neb., and the passengers in the sleeping car were robbed of about $200.

Mr. F. L. Guillaume, of Utica, has been appointed Superintendent of Station Restaurants on the New York Central. Mr. Guillaume has been proprietor of the restaurant in the station at Utica for several years. He will now have control of this and of the restaurants at Poughkeepsie, Albany, Syracuse, Rochester, Buffalo, Suspension Bridge, Weehawken and Kingston. Mr. McKee, recently appointed to take charge of the dining cars on the New York Central, will devote his attention exclusively to dining cars.

Traffic Notes.

A shipload of coal, 3,600 tons, was, last week, sent from Newport News to Cronstadt, Russia, being the first installment of 600,000 tons to be sent to Russia from the Chesapeake & Ohio district.

The Oregon Railroad & Navigation Co. announces 3 cents a mile as its uniform rate on its lines in Oregon and Washington. This action follows that of the Great Northern Pacific in reducing their passenger rates in Washington to 3 cents per mile.

The railroads of Minnesota have been notified by the State Railroad Commissioners to submit revised freight tariffs, the implication being that the Commissioners desire to make a general reduction. It is said that the Commissioners will consider the suggestions of the roads until Sept. 4 before making any order. A St. Paul newspaper intimates that political considerations constitute the motive impelling the Commissioners to activity in the direction of rate reduction at the present time.

The Grand Trunk has lately made a reduction of about 33 per cent. in rates on petroleum from Buffalo to principal points in Canada. It is said that this will revive the oil traffic from Western Pennsylvania to Canada, which has been suspended for the past two years in consequence of high freight rates. A complaint was made to the Canadian Government by independent dealers in Pennsylvania that the high rates made by the Grand Trunk were designed to unjustly favor the oil wells owned by the Standard Oil Company at Petrolia, Ont., and it appears that this complaint was duly sustained.

Freight agents west of Chicago report that from July 1 they are ordered to strictly maintain rates. The reporters say that this will close an unprecedented era of rate demoralization. This agreement, it is declared, will be observed to the letter by the forty or fifty railroads which traverse the section of country dominated by the Western Presidents' Association. It is reported, however, that the formation of the territorial committees, decided upon by the Presidents at their meeting, June 19, does not progress chiefly on account of inability to secure competent managers. W. H. Osbourne, selected as general agent of the St. Paul Committee, telegraphed declines to act. E. B. Boyd, who was to have charge at St. Louis, and C. L. Wellington (Omaha) have also declined to serve, and Mr. Courtright, of the Kansas City Committee, while not as yet declining to serve, is expected to withdraw in the near future.

The Kentucky Freight Rate Law.

The Railroad Commissioners of Kentucky have received the first complaint of excessive freight rates since the McChord law went into effect. This law, passed last March, gives the State Railroad Commissioners full power to prescribe "just and reasonable" rates for transportation of freight or passengers whenever they have received a complaint or "have reason to believe" that existing rates are extortionate. Ten days' notice will be given to an officer "or employee" of the railroad, and the matter shall be determined as speedily as possible. Orders of the Commission are to take effect 10 days after they are mailed to an officer "or employee" of the road, and neglect to obey will subject the road to a fine of not more than $1,000 for the first offense, $2,000 for the second or $5,000 for subsequent offenses. The County Circuit Courts have jurisdiction to punish offending railroads.

Oil Explosion in S. P. Roundhouse.

An explosion in an engine oil tank at Bakersfield, Col., on June 21, caused the death of two workmen and the destruction of the Southern Pacific roundhouse. Twelve engines were damaged, and, according to the press dispatches, "destroyed."

The Pennsylvania on Long Island.

Mr. Pugh is reported to have said in a recent interview that the Pennsylvania Railroad has no connection with any project for establishing a terminal for Atlantic steamships at Montauk Point. Such a plan he considers absurd. Indeed, we had not supposed that the Pennsylvania, or anybody else, took it seriously. Mr. Pugh says that the present plan of the Pennsylvania is to increase the facilities on Long Island for handling freight, and that the road is also interested in the new East River tunnel project to Brooklyn.

A Big Gun.

The U. S. Army 13-in. gun, which the Bethlehem Steel Co. of South Bethlehem, Pa., is making for the War Department, to be used in firing the Gathman torpedo, is nearing completion. It will weigh, without its carriage, 59.6 tons, and will be proved by firing ten rounds of solid shot, each weighing 2,000 pounds, and each requiring 450 pounds of powder. This test will take place some time in July at the Bethlehem Company's proving grounds.

Failure of Reservoir at Grand Rapids.

On the morning of July 2 a reservoir, covering four acres, near the city of Grand Rapids, Mich., burst open and released a hundred million gallons of water. A large territory was flooded and several hundred thousand dollars worth of property was destroyed, but only two persons were injured. Many houses and barns were swept away, but none of these buildings were of great value.

End of St. Louis Strike.

The strike of street railroad employees in St. Louis, which was begun on May 8, and which has not only been disastrous from a financial standpoint, but has been accompanied by anarchy in the city, was declared off on Monday of this week, the following agreement being signed by the President of the St. Louis Transit Co. and by the Chairman of the Committee of Employees:

1. The provisions of the agreement of March 10, 1900, as to rates of pay and hours of service will be continued in force by the company.
2. Every employee of the company to be free to join or not to join any organization, and no discrimination to be made for or against him because of the manner in which he exercises his freedom.
3. Any attempt on the part of any employee to induce another employee by intimidation or threats to join or not to join any union shall be cause for immediate discharge of the person guilty of such attempt.
4. Any attempt to influence any employees by an official of the company to join or not to join any union shall be cause for discharge of such official.
5. The company will meet any employee or committee of employees, whether representing themselves, other employees, or an association of employees, regarding any matter of mutual interest.
6. For the purpose of filling vacancies which may now exist or hereafter arise, the committee of former employees, of which T. B. Edwards is chairman, shall prepare a list of the men who were in the company's service on May 7 last and as the company now or hereafter needs additional men it will select them exclusively from this list until it is exhausted, not interfering, however, with men now in the service. No person shall be eligible to this list who has been guilty of any acts of lawlessness or violence.

This long struggle is said to have caused greater loss to the city of St. Louis than did the memorable cyclone of 1897. As a result of the strike 16 lives have been sacrificed, over 100 persons wounded by bullets and thrice that number injured by missiles or explosions. In addition to the fatalities and casualties reported the north and south ends of the city developed a species of brutality never before witnessed in a civilized community, women being stripped of their clothing in the public streets and then beaten for having ridden on the Transit Company's cars. The mob which resorted to this species of diabolism was generally made up chiefly of women and girls and half-grown boys. After the first week or two of excitement at the inauguration of the strike, the contest settled down to a steady boycott of the Transit Company and any one doing business with it. Some grocers and small merchants have been forced into bankruptcy as a result of this boycott. The authorities, both of the State and of the city, appear to have been inefficient. The Police Department of the city is not a municipal organization, but is a department of the State Government. After long delay the Sheriff called out deputies to assist the police in keeping order, but the Governor of the state persistently refused to call out the militia. It has been charged that the inaction of the Governor was due to the exigencies of party politics.

Liability for Infringement.

In the U. S. Circuit Court at Boston, will be heard a suit for $200,000 damages against Messrs. Frank Wood, Luther A. Wright and others, who were officers and directors of the Boston Cash Register Co.

This case is attracting attention on account of the principles involved, and the fact that the U. S. Circuit Court of Appeals decided that the officers and directors of an infringing company are personally liable for damages for infringement committed by their company. The suit against the Boston company was originally brought by the National Cash Register Co. of Dayton, O., in 1887. The lower court decided against the Dayton company, who carried it to the Supreme Court of the United States. The Supreme Court rendered a final decision in favor of the Dayton company. The Boston Cash Register Co. in the meantime had become insolvent and gone out of business. The National Co., therefore, sued the individual officers and directors of the Boston Cash Register Co. for damages.

CAR BUILDING.

The Southern Indiana is having four cars built by the Barney & Smith Car Co.

The Mather Stock Car Co. has ordered 50 additional box cars from the Illinois Car & Equipment Co.

The Canda Cattle Car Co. is having two cars built by the American Car & Foundry Co., at Huntington.

The Seaboard Air Line is in the market for 1,000 ventilated box cars and 1,000 flat cars, all of 30 tons capacity.

The Pittsburgh & Lake Erie is having 100 cars built by the Pressed Steel Car Co. This is in addition to the order for 150 noted in March.

It is reported that the *Union Pacific* and the *Oregon Short Line* have asked for approximate prices on 400 box cars for the former road and 700 stock, Rodger ballast, and coal cars for the latter road.

The Shreveport & Red River Valley car specifications, noted in our issue of June 29, were wrong in one particular. These cars will be equipped with the American steel truck and body bolsters, made by the American Steel Fdy. Co., and not with trucks and bolsters made by the American Car & Foundry Co.

LOCOMOTIVE BUILDING.

The Atlanta & West Point is having two 10-wheel freight engines and one six-wheel switching engine built by the Rogers Locomotive Co., as previously noted. The 10-wheel engines will burn bituminous coal; will have 20 in. x 26 in. cylinders, 61 in. in diam. drivers, cast-steel driving wheels, steel driving axles; will weigh 156,000 lbs., with 122,000 lbs. on drivers. They will have extended wagon top type boilers, with 273 iron tubes 13 ft. 9½ in. long and 2 in. in diam. The boilers will be of Carbon steel, with a working pressure of 200 lbs.; the engine truck wheels will be 30 in. in diam., with cast-iron centers and steel tires of Rogers make. The tender capacity will be 4,500 gals. The tenders will have 10 in. steel channel frames, with diamond trucks and 33 in. in diam. cast-iron, double-plate, chilled tread, wheels. The 6-wheel switching engine will burn bituminous coal; will have 18 in. x 24 in. cylinders, 51 in. in diam. drivers, cast-iron driving wheels, hammered iron driving axles; will weigh 101,000 lbs.; will have straight top radial stay steel boiler, working pressure 180 lbs., 173 tubes 13 ft. 9 1-16 in. and 2 in. in diam. The tender will have a capacity of 2,500 gals., white oak frame, Diamond arch bar trucks, 33 in. in diam., cast-iron, double-plate, chilled tread, wheels.

BRIDGE BUILDING.

Albuquerque, N. Mex.—The proposition to issue $15,000 of bonds for a viaduct over the Atchison, Topeka & Santa Fe tracks was carried at the election two weeks ago.

Arnprior, Ont.—Township Council of McNab Township will soon want tenders for a bridge on the ninth concession.

Brantford, Ont.—W. T. Jennings, C. E., of Toronto, has prepared plans for raising and extension of the Grand Trunk and Toronto & Hamilton Railroad bridges.